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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Office of Water Research and Technology,
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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05 WATER QUALITY MANAGEMENT AND PROTECTION

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07 RESOURCES DATA

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

METABOLISM OF A DESERT STREAM,
Arizona State Univ., Tempe. Dept. of Zoology.
D. E. Busch, and S. G. Fisher.
Freshwater Biology, Vol 11, No 4, p 301-307, August, 1981. 1 Fig, 1 Tab, 24 Ref.

Descriptors: *Arid lands, *Aquatic life, Deserts, Benthos, Streams, Arizona, Watersheds, Photosynthesis, Floods, Sycamore Creek, *Arizona.

An initial examination was made of photosynthesis and community respiration in a central Arizona stream, Sycamore Creek, which drains a watershed of 505 square kilometers ranging in elevation from 427 to 2164 meters. Benthos in the creek in July and August 1978 could be separated into two types, mats of a filamentous green alga, Cladophora glomerata (L.) Keutz., and microorganisms free living on the sediment (epipelon). Community respiration and net photosynthesis were measured for these assemblages using submerged light/dark chambers in situ. Multiple regression analysis was used to predict gross photosynthesis as a function of photosynthetically active radiation, temperature and chlorophyll-a concentration and community respiration as a function of temperature and biomass. The calculations suggest that the creek is autotrophic during the summer and that the rates of gross photosynthesis and community respiration are high for a small stream. Considerable differences were noted between the Cladophora mat assemblages and the epipelic assemblages. The high rate of gross photosynthesis, low litter inputs, high biomass of algae, and the intermittent but severe floods that characterize Sycamore Creek indicate that this stream and other similar desert streams are net exporters of organic matter and are thus truly autotrophic stream ecosystems. (Baker-FRC)
W82-02349

1B. Aqueous Solutions and Suspensions

THE DOWNSTREAM TRANSPORT OF FINE MATERIAL AND THE ORGANIC MATTER BALANCE FOR A SECTION OF A SMALL CHALK STREAM IN SOUTHERN ENGLAND,
Freshwater Biological Association, East Stoke (England). River Lab.
F. H. Dawson.
Journal of Ecology, Vol 69, No 2, p 367-380, July, 1981. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Natural streams, *Suspended solids, *Organic matter, Seasonal variation, Vegetation effects, Sediment load, England.

The seasonal variations in the concentration of fine particulate material transport downstream for two sites along a small chalk stream (Dorset, England) were determined. One site was shaded with deciduous trees and with a few plants growing in the water; the other was shaded and dominated by submerged macrophytes. Aquatic plants were a factor in promoting the settlement and seasonal accumulation of suspended materials as banks of sediments. The mean monthly concentration of organic matter in the summer was 1-2 mg/liter dry weight, but it rose in the winter to 10 to 12 mg/liter. The large plant material resulted from in situ macrophyte production and from terrestrial leaf fall and was quickly broken down. The accumulation of organic material was predicted by summing the difference between the monthly totals of import and export for a section of stream between two sites. (Small-FRC)
W82-02192

2. WATER CYCLE

2A. General

WATER ROUTING ON DIVERGING-CONVERGING WATERSHEDS,
Technical Univ. of Instanbul (Turkey).
N. Agiralioglu.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY8, p 1003-1017, August, 1981. 10 Fig, 3 Tab, 15 Ref.

Descriptors: *Hydrographs, *Kinematic wave theory, *Diverging-converging watersheds, *Overland flow, Model studies, Rainfall-runoff relationships, Watersheds, Streamflow, *routing.

The overland flow equations depending on the kinematic wave theory are solved by using an implicit finite difference method for the diverging-converging watershed. The flow model is applied to impervious surfaces which preserve the area and length of the watershed and fix the kinematic parameters for each event. Depending on geometric parameters, the model gives hydrograph values between those of diverging and converging models, with values for the rectangular configuration in between. Different geometric representations give runoff hydrographs with different shapes under the same conditions. The diverging representation gave the longest time of concentration, the converging representation, the shortest one. The reverse is true for lag time. (Cassar-FRC)
W82-02200

USE OF CUMULANTS TO ESTIMATE COEFFICIENTS IN CHOW-KULANDAISWAMY'S GHS MODEL,
Mississippi State Univ., Mississippi State.
V. P. Singh, and R. C. McCann.
Nordic Hydrology, Vol 11, No 2, p 83-92, 1980. 3 Fig, 1 Tab.

Descriptors: *Mathematical models, *Watersheds, *Cumulative runoff, *Floods, Water storage, Hydrograph analysis, Laplace equation, Runoff, Least squares method, Mathematical studies, Infiltration, Flood hydrographs, Discharge hydrographs.

The coefficients on the General Hydrologic System model of Chow and Kulandaiswamy are estimated using the method of cumulants. The model hypothesizes that storage in the watershed can be expressed as a linear sum of surface runoff, rainfall excess, and their time derivatives. The coefficients are functions of runoff and rainfall excess. They are finite nonnegative integers. The method of cumulants estimates the coefficients independently of the derivatives of runoff and rainfall excess. The cumulants method was found to yield comparable values to those obtained by the common least squares method. The cumulants method may be more reliable if the derivatives of runoff are not estimated accurately. (Titus-FRC)
W82-02208

ANALYSIS OF THE RAINFALL-RUNOFF TRANSFORMATION PROCESS,
Benin National Univ., Cotonou.
A. A. Afouda.
Nordic Hydrology, Vol 11, No 2, p 93-112, 1980. 4 Fig, 21 Ref.

Descriptors: *Rainfall, *Runoff, *Mathematical models, *Hydrologic roughness, *Flow, Watersheds, Kinematic wave theory, Roughness coefficients, Hydraulic friction, Boundaries, Boundary conditions, Shear stress, Reynolds number, Froude number, Stokes law.

A generalized friction factor has been introduced to describe resistance to storm water flow over a natural watershed. This theoretical relationship has been proved to be valid for smooth surface flow, rough surface flow, and flow through porous medium. A kinematic relation which accounts for the roughness of the water shed surface has been proposed. The similarity between this kinematic relation and the friction factor has been underlined. This kinematic relationship determines the applicability of the kinematic flow theory and the approximation of the friction slope. When the kinematic approximation applies, an analytical solution can be obtained in the form of integral series. (Titus-FRC)
W82-02210

RUNOFF CURVE NUMBERS FOR NORTHERN PLAINS RANGELANDS,
Science and Education Administration, Boise, ID.
C. L. Hanson, E. L. Neff, J. T. Doyle, and T. L. Gilbert.
Journal of Soil and Water Conservation, Vol 36, No 5, p 302-305, September-October, 1981. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Range management, Erosion, Runoff, Mathematical studies, Soil types, Comparison studies, Runoff forecasting.

After reviewing the various methods for estimating runoff curve number (CN) values for rangeland watersheds, a comparison was made of the values for CN prepared by the Soil Conservation Service (SCS) in Wyoming with actual records in the area. Precipitation and runoff data from several small watersheds in western South Dakota, northeastern Wyoming, and southeastern Montana were used for this evaluation. Examples of two range sites are illustrated. The maximum summer runoff event, plus any summer runoff event of 6 millimeters or more, were used to compute the optimized CN for each watershed. The optimized CN was obtained by minimizing the sum of the squared deviations of observed and predicted runoff. Precipitation and runoff were plotted and analyzed by event. The optimized CN as well as the low and high values were computed so that the procedures outlined in the National Engineering Handbook could be expanded to Northern Plains rangeland. The computed CN values were integrated into the original Wyoming table. Optimized CN values ranged from 50 for a sandy watershed to 93 for a saline upland watershed in low-fair condition. Optimized values from the watersheds varied considerably, but their range included the value from the original table in all cases. Claypan watersheds had optimized CN values of 87 and 89, slightly lower than the values of the original table. Shallow loamy range sites had slightly higher CN values than on the original table, while three clayey watersheds had values similar to those in the table. Values similar to those on the original table were obtained for medium-textured soils, fine-textured soils with steep slopes, and primarily clayey range site watersheds. (Baker-FRC)
W82-02245

SNOWMELT, GLACIER MELT, AND HIGH ARCTIC STREAMFLOW REGIMES,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
P. Marsh, and W. Ming-ko.
Canadian Journal of Earth Sciences, Vol 18, No 8, p 1380-1384, August, 1981. 4 Fig, 6 Ref.

Descriptors: *Streamflow, *Arctic, *Snowmelt, Thaw, Glaciers, Seasonal variation.

The major sources of streamflow in high arctic basins were analyzed, and the flow generating process was examined. The study was carried out in an area characterized by a dissected plateau ranging in altitude from 120 to 425 m. Streamflow was the result of rainfall, spring snowmelt, and the melting of semi-permanent snowbanks and glaciers. When spring snowmelt dominated, a simple arctic nival regime resulted. When spring melt was followed by glacier melt, a typical proglacial regime resulted. Flows from year to year were highly variable, depending upon weather conditions and the rates of various sources of runoff. A complex range of regime types can be defined, and the simple classification of nival or proglacial can be used. (Small-FRC)
W82-02249

Group 2A—General

FLOOD EVENT MODELING - A STUDY OF TWO METHODS,
Institute of Hydrology, Wallingford (England).
M. J. Lowing, and R. G. Mein.
Water Resources Bulletin, Vol 17, No 4, p 599-606, August, 1981. 10 Fig, 2 Tab, 8 Ref.

Descriptors: *Mathematical models, *Design floods, *Runoff forecasting, Hydraulic design, Floods, Maximum probable floods, Surface runoff, Hydrographs, Comparison studies, Watersheds.

Two methods for the estimation of design flood hydrographs for gaged catchments were applied to five gaged catchments in the United Kingdom. The unit hydrograph model and a runoff routing model used in Australia were evaluated. Both models acted on rainfall excess to produce estimates of surface runoff. Both models performed well, but for many situations, the unit hydrograph procedure was more suitable. It is simple to apply and can be computed by hand. The runoff routing model has the advantage of allowing for nonuniformity within the catchment in rainfall depth or pattern, losses due to different soils or land use, or the existence of significant storages or retarding basins. This model, however, requires a computer. Alternative ways of describing the within-event distribution of losses are an important factor in the success of a model. (Small-FRC)
W82-02291

CHEMISTRY OF INTERSTITIAL WATER AND BOTTOM SEDIMENTS AS INDICATORS OF SEEPAGE PATTERNS IN PERCH LAKE, CHALK RIVER, ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
S. K. Frape, and R. J. Patterson.
Limnology and Oceanography, Vol 26, No 3, p 500-517, May, 1981. 11 Fig, 29 Ref.

Descriptors: *Groundwater movement, *Seepage, *Lakes, Interstitial water, Sediment-water interfaces, Chemical properties, Tritium, Tracers, *Perch Lake, Ontario, *Chalk River.

Theoretical subsurface, nearshore flow models were tested, and information was obtained on seepage water and the chemical processes that may occur during the passage of groundwater through lake bottom sediments in a study of Perch Lake (Chalk River, Ontario). The groundwater flow system in this lake basin has been extensively monitored, and an aquifer near the lake was contaminated with tritium, acting as a good tracer. Tritium analyses of interstitial water samples and well waters near the lake indicated a pattern of groundwater discharge or seepage consistent with the predictions of the mathematical models. Groundwater discharge deposited metals such as iron and manganese in lake sediments. Interstitial waters in sediments were mixtures of groundwater and lake water, with the resultant chemistry. Nests of piezometers adjacent to the lake are needed to define the types of groundwaters moving toward the lake. (Small-FRC)
W82-02304

FLASH FLOOD IN ARIZONA - OBSERVATIONS AND THEIR APPLICATION TO THE IDENTIFICATION OF FLASH-FLOOD DEPOSITS IN THE GEOLOGIC RECORD,
Geological Survey, Flagstaff, AZ.
I. Lucchitta, and N. Suneson.
Geology, Vol 9, p 414-418, September, 1981. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Sediment transport, *Flash floods, Floods, Rainfall-runoff relationships, *Arizona, Sediments.

A description is offered of a flash flood which occurred in west central Arizona in the spring of 1979. The flood occurred in the area of a major branch of Rupley Wash, which is one of the principal washes of the area and a tributary of the Big Sandy River. This branch drains an area of about 18 square kilometers underlain by Quaternary pediments, badland hills cut into upper Tertiary basin-fill deposits, and highlands underlain by Precambrian granite, Cenozoic sedimentary rocks, and Cenozoic rhyolite and basalt. The branch is a typical braided desert wash, consisting of many unvegetated, sandy and pebbly, active braid channels separated by vegetated, inactive areas. Ten to 15 minutes after the torrential rain started (shortly afternoon) the pediment surface was completely saturated and water 1 to 2 cm deep was moving in sheetflow. A few minutes later the depth was 10-20 cm. The most active part of the braid channel soon contained muddy, turbulent water 20-50 cm deep. The maximum velocity for the water was estimated at 2.5 to 3.8 meters/second. After about 30 minutes the flood was gone and the rain had almost stopped. The flood in the main channel left two kinds of deposits: widespread coarse to medium grained quartz feldspar sand, and less widespread but conspicuous medium- to fine grained sand composed of magnetite with a little ilmenite, termed black sand. It was not certain whether the flood resulted in a net accumulation or removal of material in the channel. (Baker-FRC)
W82-02350

A METHOD FOR OBTAINING SLOPE INFORMATION FOR HYDROLOGIC MODELS,
Ball State Univ., Muncie, IN. Dept. of Geography.
B. N. Haack.
Water Resources Bulletin, Vol 17, No 4, p 704-707, August, 1981. 2 Fig, 6 Ref.

Descriptors: *Nonpoint pollution sources, *Hydrologic models, *Slopes, Water pollution sources, Model studies, Watersheds, *Runoff, Data collections, Pollution load, Sediment, Erosion, Topography, Topographic mapping, Contours.

A method is presented for collecting surface slope information for a regional land resources information system. Slope is a necessary and important factor in water quality and soil loss models and is often difficult to obtain. The method described requires a point sampling scheme, topographic maps, and a coordinate digitizer. Sample point evaluation, slope direction, and slope magnitude are calculated from locations of the sample point and the nearest upper and lower contour lines. Slope gradient can be a useful addition to a point sampled land resources information system for the correlation of water quality data and simultaneously occurring land resource data for watershed runoff and nonpoint source water pollution analysis. Slope length, while also useful, cannot be obtained from the method presented here. One possible problem with the method is cost. In the Honey Creek project, a two person collection team averaged about 100 sample points per hour for slope data collection. Monetary restraints restricted this method to the Honey Creek watershed for the Lake Erie Wastewater Management Study. One possible source of error in the method proposed is digitizer limitations in measuring short distances. This is of particular concern when measurement distances are small, for example when a sample point is on a steep slope, as indicated by closely spaced contour lines. As long as the contour lines are uniformly spaced, the distance for digitizer measurements could be increased and small distance measurement errors decreased by selecting contour lines for slope determination other than those immediately adjacent to the sample point. (Baker-FRC)
W82-02364

METHODS OF CALCULATING INFILTRATION OF MELTWATERS INTO FROZEN SOIL,
I. L. Kalyuzhnyi, and K. K. Pavlova.
Hydrotechnical Construction, No 4, p 375-379, April, 1980. 7 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 4, p 29-32, April, 1980.

Descriptors: *Snowmelt, *Infiltration capacity, Infiltration, Melting, Leaching, Free water, Soil properties, Frozen ground, Freezing, Catchment areas, Soil moisture, *Mathematical studies, Runoff, Floods, Spring flood runoff, Freeze-thaw tests.

An analysis was made on the formation of the spring flood runoff which demonstrated that for certain relationships of the temperature and moisture content of the soil, and impermeable layer can form at one depth or another. Its formation is most probable near the surface. Given the existence of an impermeable layer, its widespread distribution on the drainage basin, and lengthy existence, the losses of the spring flood runoff are as a rule small. On field drainage basins of the forest and forest-steppe zones an impermeable layer is formed rather often in the soil, and on forest drainage basins only rarely, due to the difference in the hydrophysical properties of field and forest soils. The duration of the existence of an impermeable layer depends primarily on the soil temperature or freezing depth, but the portion of the area of the drainage basin occupied by this layer depends primarily on the soil moisture content in the upper 20 centimeters. The thickness of the impermeable layer is related to the soil impermeability index, and the portion of the area of the drainage basin occupied by this layer is related to the average moisture supply in the 20 centimeter layer. The product of permeability and moisture content in this layer was taken as the integral index of meltwater runoff losses. Close relations between spring flood runoff coefficient and the loss index were obtained for field drainage basins of forest and forest-steepe zones. (Baker-FRC)
W82-02386

POINT PROCESS MODELS OF RAINFALL,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. A. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157959, Price codes: A09 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1980. 182 p, 17 Fig, 19 Tab, 72 Ref. OWRT-B-027-MD(2) and C-90308-C(0407)(1), 14-34-0001-0407, 14-34-0001-8089.

Descriptors: Simulated rainfall, Prediction, Stochastic process, *Model studies, Precipitation, Rainfall, Drought, Forecasting, Probabilistic process, *Rainfall-runoff relationships, *Low flow, *Streamflow forecasting, *Potomac River basin.

Point process models of summer rainfall for the Potomac River basin are developed for application to streamflow prediction during drought periods. The point process models that are developed include (1) a univariate point process model of rainfall occurrences at a site, (2) a marked point process model of rainfall occurrences and storm depths at a site, and (3) a bivariate point process model of rainfall occurrences at two sites. The univariate point process model of rainfall occurrences, which is denoted an RCM process (for Renewal Cox process with Markovian intensity), is the centerpiece of this dissertation. An RCM process can be described as a point process for which the rate of occurrence of events alternates randomly between two states, one of which is 0, the other positive. The notion of clustering of rainfall occurrences plays an important role in this dissertation. The form of the RCM process suggests an interpretation of clustering of rainfall occurrences based on the alternation of wet and dry periods. This interpretation is supported by presenting evidence which indicates that periods of deficit summer rainfall in the Potomac basin are closely associated with the advection of cool, dry, stable Canadian air masses.
W82-02452

RAINFALL-RUNOFF MODELING AND PRELIMINARY REGIONAL FLOOD CHARACTERISTICS OF SMALL RURAL WATERSHEDS IN THE ARKANSAS RIVER BASIN IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. K. Livingston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-224313, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-112, 1981. 43 p, 7 Fig, 9 Tab, 43 Ref.

Descriptors: *Model studies, *Flood data, *Small watersheds, *Rainfall-runoff relationships, Storm runoff, Runoff forecasting, Flood flow, Stream-

flow, Flood peak, Flood frequency, Regional analysis, Frequency analysis, Estimating, Hydrographs, *Colorado, *Arkansas River basin.

Both recorded and synthetic rainfall-runoff and annual peak-discharge data for 17 rural watersheds were analyzed to evaluate the magnitude, frequency, and volume of floods in the plains region of the Arkansas River basin in Colorado. Flood-frequency relations from analysis of recorded data were weighted or combined with flood-frequency relations from analysis of synthetic data to provide improved estimates of selected flood characteristics for 15 of these watersheds. The 10-, 25-, 50-, and 100-year peak discharges were regionalized using multiple-regression and station-year methods. Regression relations were developed to determine peak discharge from effective drainage area (standard error of estimate 30 to 50 percent) and flood volume from peak discharge (standard error of estimate 62 percent) for ungaged basins between 0.5 and 15 square miles in size. Using these two flood characteristics, a dimensionless hydrograph method provides synthetic hydrographs very similar in shape to recorded flood hydrographs. (USGS)
W82-02462

SELECTING SEASONAL STREAMFLOW MODELS,
Idaho Univ., Moscow. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 2E.
W82-02502

COMPARISON OF BEHAVIOR OF TWO SUB-BASINS IN THE TURTLE CREEK DRAINAGE SYSTEM,
Beloit Coll., WI. Dept. of Geology.
R. C. Stenstrom, and A. Witmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157819, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin, Madison, Technical Report WIS-WRC-81-04, 1981. 29 p, 26 Fig, 1 Tab, 10 Ref. OWRT-A-091-WIS(1), 14-34-0001-0153.

Descriptors: *Agricultural watersheds, Basins, Drainage area, Drainage systems, Flood control, Floods, Precipitation, Rain gages, Rainfall, Rainstorms, *Urban watersheds, Watersheds, *Rainfall-runoff relationships, *Little Turtle basin, *Spring Brook basin, Wisconsin.

During the summer and fall of 1980 the Little Turtle and Spring Brook Sub-basins of the Turtle Creek Drainage in southern Wisconsin were studied for the response to rainfall events. Surface and subsurface characteristics of the two basins were similar, however, the shape and drainage features differed markedly. Each basin was monitored by 10 rain gauges and two recording rain gauges placed at the ends of a line running approximately east-west through the basin. Observations of three events show that in urbanized areas of Spring Brook the reduced lag time for storm runoff leads to multiple peaks from a single rainfall. Preliminary calculations indicate a larger discharge from the storm-sewered area than from the unurbanized segment of the basin, even though it represents only about 25% of the area. The response of the unurbanized segment is not as complex. However, the Little Turtle Basin, with its many tributaries, produces a multiple peaked flow from three various lag times for tributary arrivals. Because of the complexity involved, the behavior of the basins in a number of storms must be examined before a valid model can be attempted.
W82-02528

MATHEMATICAL MODELS OF WATER YIELD WITH PARTICULAR REFERENCE TO MISSISSIPPI WATERSHEDS, INTERIM REPORT NO. 2: MATHEMATICAL MODELING OF WATERSHED YIELD,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. P. Singh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157868, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October, 1981. 50 p, 12 Fig, 5 Tab, 58 Ref. OWRT-A-129-MISS(2), 14-34-0001-1126.

Descriptors: *Watersheds, *Mathematical models, *Water yield, Antecedent moisture content, Evapotranspiration, Effective precipitation, Infiltration, Rainfall-runoff relationships, Deep percolation, Base flow, Meteorology, Soil moisture, *Mississippi, Hamon model, Haan model, TVA model, Water balance model, SCS curve number model, Singh-Dickinson model.

The objective of this project is to develop procedures for determination of daily, monthly and yearly yields of water for small natural watersheds with particular reference to the State of Mississippi. These procedures will employ simple systems analysis techniques so that they can be readily utilized in solution of practical problems relating to water resources management and development. An important aspect of this study pertains to determination of sediment yield and sediment discharge graph for a given rainfall episode. In the second year of this study an attempt was made to develop simple mathematical tools for establishing a relationship between storm runoff and the resulting sediment yield for small upland watersheds. These tools can be useful in planning and management of water resources. Currently there exists a multitude of water yield models developed in various parts of the U.S.A. A survey of these models has been made which indicates that one model is not uniformly better than the other. Each model has its strengths and weaknesses. Our aim is to synthesize those components of the models which are particularly suited for this project.
W82-02533

NUTRIENT CONTENTS OF PRECIPITATION AND CANOPY THROUGHFALL UNDER CORN, SOYBEANS, AND OATS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 2I.
W82-02574

2B. Precipitation

PRECIPITATION TRENDS AND VARIABILITY IN THE VICINITY OF NORTHWEST GULF COAST: 1900-1980,
Texas A and I Univ., Kingsville. Dept. of Geography and Geology.
For primary bibliographic entry see Field 2L.
W82-02159

RAINFALL-RELATED TRENDS IN THE STRUCTURE OF A FISH-CRUSTACEAN COMMUNITY IN TEXAS' GALVESTON BAY SYSTEM,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 2L.
W82-02160

ACCURACY OF POINT PRECIPITATION MEASUREMENTS,
Danish Meteorological Inst., Copenhagen.
P. Allerup, and H. Madsen.
Nordic Hydrology, Vol 11, No 2, p 57-80, 1980. 4 Fig, 5 Tab, 12 Ref.

Descriptors: *Precipitation, *Rainfall rate, *Rainfall distribution, Gages, Wind, Rainfall area, Net rainfall, Rain gages, Measuring instruments, Wind gages, Windbreaks.

The normal-exposed Hellmann raingauge only catches 85 per cent of the true precipitation on a yearly basis. This is mainly due to aerodynamic effects. A statistical model analyzing the ratio of daily amounts of precipitation measured at ground level and at standard height is set up for describing this influence. This model relates the ratio between liquid precipitation measured at ground level and at standard height to wind speed during rain and rain intensity. It is well-suited for automatic weather stations where simultaneous measurements of wind speed and rain intensity are performed. Corrections due to liquid and solid precipitation are presented, as are corrections for different sheltered and unsheltered exposures. (Titus-FRC)
W82-02209

DENDROCLIMATIC ESTIMATES OF A DROUGHT INDEX FOR NORTHERN VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
L. J. Puckett.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00 in paper copy. Geological Survey Water-Supply Paper 2080, 1981. 39 p, 7 Fig, 7 Tab, 39 Ref.

Descriptors: *Dendrochronology, *Climatology, *Drought, *Precipitation, Evapotranspiration, Estimating, Hemlock trees, Sampling, Sites, Temperature, Regression analysis, Moisture stress, Moisture deficiency, Water shortage, Climatic data, *Virginia, Northern Virginia, Palmer drought severity index.

Tree-ring widths were used to calculate a 230-year estimate of the July Palmer drought severity index (PDSI) for northern Virginia. Samples of eastern hemlock were collected at three locations in northern Virginia. Annual growth increments were measured and converted to standardized indices. The response of growth to climate was determined to be positively correlated with precipitation and negatively correlated with temperature during the May-July growing season. Multiple regression was used to calculate a mathematical formula for the growth-climate relationship. Growth accounted for 20-30 percent of the PDSI variance, using the standardized indices. Factor scores of the standardized indices were only slightly better predictors of PDSI. Greatest improvement was made by using factor scores of individual trees. With this procedure 64 percent of the July PDSI variance was accounted for. Comparison of the results with a 279-year estimate of July PDSI from New York, showed agreement between low-frequency climatic trends. Analysis of the Central Mountain climatic division PDSI estimate indicated that dry years occurred most frequently during the last half the 19th and mid-20th centuries. These results are considered as first generation products, and suggest that with refined techniques more accurate estimates of prior climatic conditions will be possible. (USGS)
W82-02468

2C. Snow, Ice, and Frost

MEAN CHARACTERISTICS OF ASYMMETRIC FLOWS: APPLICATION TO FLOW BELOW ICE JAMS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
M. Gogus, and J-C. Tatinclaux.
Canadian Journal of Civil Engineering, Vol 8, No 3, p 342-350, September, 1981. 12 Fig, 13 Ref.

Descriptors: *Ice jams, *River flow, Rivers, Ice, Hydraulics, Model studies, Simulation.

This study attempts to quantify the interaction between two parallel flow boundaries with different roughness characteristics. Only rigid and essentially plane boundaries are considered, to eliminate the complicating factors of sediment transport and bed form that a movable bed would have introduced. Parameters to be identified are the friction factors at both boundaries, the relative extent of the zones of influence of the boundaries as delimited by the location of the maximum velocity, average velocities in these two zones, and the shear stress or friction factors at the interface between these two zones. The study was performed in a laboratory flume. Contrary to common assumption, the location of the maximum velocity was not a point of zero shear stress when the bed and the cover had different roughness characteristics.

Semi-empirical and graphical relationships between bed and cover friction factors, relative location of maximum velocity, and bed and cover roughness sizes are presented which are sufficient to estimate the mean flow characteristics below the cover for a given flow discharge and flow depth below cover. The results of this study may be significant in calculating characteristics of river ice jams in their initial stage of formation when their roughness is significantly greater than that of the river bed. (Baker-FRC)
W82-02237

CLIMATIC RELATIONSHIPS OF PERMAFROST ZONES IN AREAS OF LOW WINTER SNOW-COVER,
Calgary Univ. (Alberta). Dept. of Geography.
S. A. Harris.
Arctic, Vol 34, No 1, p 64-70, March, 1981. 10 Fig, 34 Ref.

Descriptors: *Permafrost, *Snow cover, *Cold regions, Arctic, Arctic zones, Frozen ground, *Climatology, Seasonal variation, Climates, Norway, Iceland, Spitzbergen, Canada, Mongolia, Prediction, Climatic zones, Semiarid climates, Spatial variation.

This paper discusses a new method of climatic prediction for specific conditions which are fairly widespread in permafrost regions. It then examines the spatial variation of some climatic data from semi-desert to permafrost regions in parts of western North America. In areas with under 50 cm snow cover in winter, the permafrost zones show diagnostic long term freezing indices and thawing indices. The warmer boundary of the zone of continuous permafrost traverses the mean annual air temperature (MAAT) isotherm. The boundary between discontinuous and sporadic permafrost lies just on the cold side of zero degrees centigrade MAAT. The sporadic permafrost zone includes the zone of ice caves and the regions with patches of ice beneath ponds and peat bogs, extending to 5 degrees C MAAT at a thawing index of 4000 degree days per year. The relationship is applicable to Norway, Iceland, Spitzbergen, Canada and the People's Republic of Mongolia. (Baker-FRC)
W82-02239

ESTIMATES OF THE MAGNITUDE OF GLACIER OUTBURST FLOODS FROM LAKE DONJEK, YUKON TERRITORY, CANADA,
British Columbia University, Vancouver. Dept. of Geophysics and Astronomy.
G. K. C. Clarke, and W. H. Mathews.
Canadian Journal of Earth Sciences, Vol 18, No 9, p 1452-1463, September, 1981. 5 Fig, 7 Tab, 26 Ref.

Descriptors: *Glacial lakes, *Flood forecasting, Ice, Donjek River, Rivers, *Canada, Melt water, Runoff, *Lake Donjek.

A close examination of the probable magnitude of outburst floods which may be expected from Lake Donjek in the next 50 years has been made. Few tools exist for determining the flood potential of glacier-dammed lakes. This study began by selecting an outburst flood from a reservoir of comparable size to Lake Donjek and using this flood as a reference against which to compare predictions for Lake Donjek. In the simulation model constructed, water volume was one of several factors which influenced flood magnitude. The flood data employed resulted from the event in September 1967 when Summit Lake emptied. This lake is dammed by Salmon Glacier and empties through a 12 kilometer ice tunnel into the Salmon River. A transition occurred from stable surface drainage to unstable subglacial drainage. The December 1961 outburst flood from Summit Lake damaged the Ninemile bridge across Salmon River and an access road. There are 15 recorded outburst floods from Summit Lake. The simulation model constructed was able to reproduce the essential features of the discharge hydrogen for the September 1967 outburst from Summit Lake. The volume of Lake Donjek reservoir is currently roughly 234,000,000 cubic meters, depending on the point to which the ice margin moves during a glacier advance. The empirical Clague-Mathews formula predicts a peak discharge of 2900 cubic meters per second for Lake Donjek floods. The simulation model predicts that outburst floods from Lake Donjek are likely to be more severe than those from Summit Lake. A maximum discharge in the range of 677 to 5968 cubic meters per second is predicted. The most probable range is 3968-5938 cubic meters/second. (Baker-FRC)
W82-02241

SNOWMELT, GLACIER MELT, AND HIGH ARCTIC STREAMFLOW REGIMES,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W82-02249

SUMMER REAERATION AND WINTER ICE REMOVAL FROM LAKES AND RESERVOIRS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2H.
W82-02526

SNOW BARRIER POTENTIAL FOR HARVESTING MOISTURE IN TRANSECTS ACROSS CHINOOK AREAS IN MONTANA--SUMMARY REPORT,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
J. M. Caprio, G. K. Grunwald, and R. D. Snyder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157926, Price codes: A06 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 115, September, 1981. 92 p, 24 Fig, 18 Tab, 15 Ref. OWRT-B-046-MONT(1).

Descriptors: *Soil moisture, Snow cover, Climatology, Field investigations, Lysimeters, Soil moisture retention, *Water harvesting, *Snow traps, Snowmelt, *Chinook belt, *Montana, Stubble fields.

The differential effects of snow barriers for trapping moisture in the chinook region of Montana were evaluated on standing small-grain stubble. During each of three winters treatments at each of 4 to 6 experimental sites on each of two transects included fallow and adjacent stubble areas situated in alternating north-south strips approximately 50 meters wide. Observations at each site included depth and density of snow cover, precipitation, near-surface soil moisture, depth of frozen ground, and moisture collected in mini-lysimeters. The results indicated that (1) ground froze about 20 to 30% deeper in fallow fields, (2) soil moisture in the 0-15 cm surface layer averaged slightly greater during the winter in stubble fields, (3) snow depth was greater in standing stubble and varied from 80% more during the driest winter to only about 30% more during wettest winters, (4) mini-lysimeters caught about 75% more water in standing stubble fields during the dry winter, but differences of only a few percent were noted during the wet winter, (5) snowmelt recharge efficiency (SRE) for mini-lysimeters was about 20% less in chinook areas compared to non-chinook areas during the dry year. Data from saturated mini-lysimeters in late summer indicated that evaporation is reduced about 40% by the presence of standing stubble. A model using lysimeter SRE suggests that both stubble efficiency and non-chinook efficiency vary inversely as the amount of winter precipitation. (Hunt-Mont)
W82-02539

COMPARISON OF AREAL SNOW STORAGE SAMPLING PROCEDURES FOR RANGELAND WATERSHEDS,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
W. J. Rawls, T. J. Jackson, and J. F. Zuzel.
Nordic Hydrology, Vol 11, No 2, p 71-82, 1980. 2 Tab, 7 Fig, 15 Ref.

Descriptors: *Watersheds, *Range management, Snow sampling, Snow, *Snow surveys, Snow storage, Sampling, Snow accumulation, Old snow, Snow management, Snow depth, Snow samples, Remote sensing, Photogrammetry, Comparison studies, Reynolds Creek Experimental Watershed, *Idaho.

The accuracy of photogrammetry in determining snow depth in mountainous reangland watersheds was evaluated on a subbasin of the reynolds Creek Experimental Watershed in southwestern Idaho. Random checking of points indicated that snow depths were determined with a standard error of + or - 15 cm for a mean snow depth of 1.2 m. The lag time between the photography and the usable result and the need for a coordinated field survey make the technique a research tool. As the total watershed snow cover decreased, more samples were needed to produce the same level of accuracy. Accurately could be improved by setting a grid perpendicular to the direction of the predominant wind. (Titus-FRC)
W82-02555

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION AND LEAF WATER STATUS OF ALFALFA GROWING UNDER ADVECTIVE CONDITIONS,
British Columbia Ministry of Environment, Kamloops.
R. J. Williams, and D. G. Stout.
Canadian Journal of Plant Science, Vol 61, No 3, p 601-607, July, 1981. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Alfalfa, *Advection, *Water potentials, Leaves, Crop yield, Plant growth, Evapotranspiration control, Evapotranspiration potential, *Evapotranspiration.

The objectives of this study were to examine the contribution of advection to evapotranspiration from alfalfa and to determine the influence of evapotranspiration on alfalfa water status. Measurements were conducted during the 1978 growing season in a field of irrigated alfalfa located near Kamloops, British Columbia, in the Thompson River valley. A potentially large heat source in the form of an oil refinery was situated to the south. Percent soil moisture data were determined gravimetrically throughout the summer at depths of 2.5, 10, 20, and 50 cm. The two sampling periods, early August and early October, both followed irrigation of the entire field. During periods of advection, actual evapotranspiration (LE) as measured by the Bowen ratio energy balance method exceeded both the net radiation and the potential evapotranspiration (PE) calculated by the physically based formula of Priestly and Taylor. During advection the net radiation was a better approximation of LE than was PE. During nonadvection periods LE was about equal to PE. It was noted that a modification of PE as designed by Jury and Tanner in 1975 for advective conditions gave favorable results during priods immediately following irrigation. Diurnal measurements revealed that the leaf osmotic potential reached a minimum by about 1200 hr and then remained constant even though LE continued at a high rate. Leaf osmotic potential measured at 0800 hr reflected soil moisture conditions. At 1400 hr, leaf osmotic potential reflected both soil moisture conditions and environmental demand. (Baker-FRC)
W82-02295

PRACTICAL PREDICTION OF ACTUAL EVAPOTRANSPIRATION,
International Inst. for Land Reclamation and Improvement, Wageningen (Netherlands).
P. J. Slabbers.
Irrigation Science, Vol 1, No 3, p 185-196, 1980. 7 Fig, 1 Tab, 41 Ref.

Descriptors: *Evapotranspiration, *Water potential, *Soil-water-plant relationships, Prediction, Irrigation requirements, Leaves, Soil moisture deficiency, Water use, Developing countries, Corn, Alfalfa, Soybeans, Sorghum, Wheat, Potatoes.

A simplified method is presented for predicting actual evapotranspiration. It is suitable for use in

developing countries lacking the necessary data for sophisticated techniques. A relationship is developed between a crop-dependent critical leaf water potential, potential evapotranspiration rates, and the fraction of available soil moisture at which a reduction in evapotranspiration occurs. Several simplifying assumptions are made to reduce the amount of field data required for calculations. The calculated and measured rates of evapotranspiration agreed well for maize, alfalfa, sorghum, wheat, and soybean crops, but not for potato. For crops with critical leaf water potentials above -7.5 bars, there was a 10% error in estimating the fraction of available soil moisture at which reduction in evaporation occurs. The method is not applicable for crops grown in greenhouses, hydroponics, saline conditions, root asphyxia, or extreme moisture regimes. (Cassar-FRC)
W82-02308

2E. Streamflow and Runoff

SURFACE WATER FLOW FROM A SOUTH FLORIDA WETLAND AREA,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL. Div. of Ocean Engineering.
J. van de Kreeke, and E. Daddio.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in papercopy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol. I, October, 1981. p 232-240, 5 Fig, 4 Ref.

Descriptors: *Wetlands, *Surface flow, *Rainfall-runoff relationships, Mangrove swamps, Marshes, Water discharge, Elevation, Evapotranspiration, *Florida, Runoff.

The study site is a wetland region of approximately 5,300 acres near Marco Island in southwest Florida. Vegetation ranges from impounded mangrove wetlands on the south, to freshwater marsh, to pine, palmetto, and farm areas on the north. Elevations grade from about 0.6 m a.s.l. along the southern boundary to 1.5 m on the north. The basin has been divided into two separate hydrologic units by construction of the Belle Mead Grade. Water export was determined with a semi-empirical relationship between discharge and water elevation differences across culverts which convey surface runoff out of the study area. Monthly water export ranges from 270,000 cu m/month for November 1977 to 3,510,000 cu m/month for July 1977. The total rainfall for the one year period beginning June 1977 is 144 cm or 31,100,000 cu m for the drainage basin, of which 16,600,000 cu m was discharged through the culverts. This yields a runoff ratio of 0.53. Assuming no net water storage over a period of a year, the remaining 47% of rainfall is lost largely by evapotranspiration. (Moore-SRC)
W82-02121

FRESHWATER FLOW RATES AND DISTRIBUTION WITHIN THE EVERGLADES MARSH,
National Park Service, Homestead, FL.
P. C. Rosendahl, and P. W. Rose.
.vailable from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 385-401. 9 Fig, 1 Tab, 6 Ref.

Descriptors: *Shark River Slough, Florida, *Flow rates, *Flow discharge, *Remote sensing, Laminar flow, Spatial distribution, Water storage, Seasonal variation, Flooding, Aquatic productivity, Everglades.

The Shark River Slough originates outside and flows into the Everglades National Park. A minimum annual flow rate of 260,000 acre-feet into the park has been mandated, and, because of the slough dimensions and low hydraulic gradients, new techniques for discharge and distribution were required. A tracer dye was used in conjunction with Landsat imagery to determine sheet flow rates, spatial distribution and volumetric storage. Velocities of 0-0.035 ft/s were measured, below the detection limits of conventional instruction. When coupled with cross-sectional area calculations, a reasonable estimate of the slough's contributions to the estuarine region was 200-2000 cu ft/s. Freshwater distribution within the slough was subject to seasonal inundation fluctuating between 90,000 - 245,000 acres, providing storage estimates between 26,000 - 208,000 acre-feet for the dry and wet seasons, respectively. Such shifts in available surface water play a significant role in driving the productivity of the Everglades ecosystem. (Brambley-SRC)
W82-02163

AQUIFER RESPONSE DUE TO ZONES OF HIGHER PERMEABILITY AND STORAGE COEFFICIENT,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W82-02190

DISTRIBUTION OF JOINT RUN-LENGTHS OF BIVARIATE MARKOV PROCESSES,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
M. Bayazit.
Journal of Hydrology, Vol 50, No 1-3, p 35-43, March, 1981. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Drought, *Streamflow, *Joint negative run lengths, Markov process, Rivers, Hydrology, Stochastic process, Mathematical studies, Monte Carlo method.

A theoretical expression is derived for the probability distribution of joint negative run lengths of stationary, mutually and serially dependent bivariate Markov processes. Negative run length, defined as the length of the period during which a stream flow remains continuously below a certain truncation level, characterizes a drought or dry period occurring at two locations simultaneously. It was found that the joint negative run lengths are distributed geometrically with a parameter that depends on the correlation coefficient and the truncation level. The derived equations were applied to monthly and annual flow records from two pairs of rivers (Gota and Vuoksi, Danube and Elbe) with reasonable agreement. (Cassar-FRC)
W82-02191

MEAN CHARACTERISTICS OF ASYMMETRIC FLOWS: APPLICATION TO FLOW BELOW ICE JAMS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2C.
W82-02237

ESTIMATES OF THE MAGNITUDE OF GLACIER OUTBURST FLOODS FROM LAKE DONJEK, YUKON TERRITORY, CANADA,
British Columbia University, Vancouver. Dept. of Geophysics and Astronomy.
For primary bibliographic entry see Field 2C.
W82-02241

FLOOD EVENT MODELING - A STUDY OF TWO METHODS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W82-02291

PERIPHYTON PRODUCTION IN AN APPALACHIAN MOUNTAIN TROUT STREAM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W82-02335

METABOLISM OF A DESERT STREAM,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 1A.
W82-02349

A REVIEW OF SINGLE-SITE MODELS FOR MONTHLY STREAMFLOW GENERATION,
Asian Inst. of Tech., Bangkok (Thailand).
H. N. Phien, and W. Ruksasilp.
Journal of Hydrology, Vol 52, No 1/2, p 1-12, June, 1981. 3 Tab, 18 Ref.

Descriptors: *Streamflow, *Model studies, Simulation, Computers, Standard deviation, Mathematical studies, Monthly distribution.

Models for the generation of monthly streamflows are considered and modified with a view to preserving the three important descriptors, the mean, standard deviation and skewness coefficient of each monthly sequence. In order to evaluate the four models used, the number of negative values generated and the computer time required are also considered. The four models were the Thomas-Fiering model, the First Spolia-Chander model, the Second Spolia-Chander model, and the Sen model. It was noted that monthly means and standard deviations of the historical sequences were preserved very well by all the models under study, even though a moderate size of 1000 yr was used for generated sequences. The historical records of the Mekong River are negatively skew for several months, while those of the Ping and Pasak Rivers are always positively skew. For the second model of Spolia and Chander, an unacceptable value for the skewness coefficient was obtained from the 1000 yr generated sequence. The skewness coefficient of the random component in the modified model of Spolia and Chander with a second-order autoregressive process for the residul series can be computed. In addition to being able to preserve the aforementioned descriptors of historical records, the Thomas-Fiering model is simple in parameter estimation and thus produces less negative values and consumes less computer time. Thus it is recommended for use as long as one is concerned with the preservation of the mean, standard deviation, and skewness coefficient of historical data. (Baker-FRC)
W82-02368

RELATIONSHIP OF THE ROUGHNESS COEFFICIENT MANNING'S N AND DISCHARGE IN AN URBAN RIVER,
University Coll., London (England). Dept. of Geography.
G. Richards, and G. E. Hollis.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 357-360, July, 1980. 2 Fig, 5 Ref.

Descriptors: *Flow discharge, *Rivers, *Field tests, *Channel flow, *Roughness coefficients, Channel morphology, Velocity, Mathematical models, Mathematical equations, Cross sections, Electronic equipment, Brent River, London, England.

Recent work has shown that the widely used Manning formula employing published values of the roughness coefficient, n, can be misleading. In a study of five large natural channels, Sargent found that as discharge increased, Manning's n decreased toward an asymptotic value as bankfull discharge was approached. In three of five reaches the observed values of n were consistently below those that would have been assumed in the absence of experimental evidence. Data from the river Brent in London is presented which confirms these criticisms and highlights the problems of characterizing channel roughness with a single value. (Titus-FRC)
W82-02376

POSSIBILITY OF INVESTIGATING OPEN-CHANNEL FLOWS ON AN ANALOG COMPUTER,
For primary bibliographic entry see Field 6A.
W82-02389

THE RELATIVE INFLUENCE OF DAMS AND SECULAR CLIMATIC CHANGE ON DOWNSTREAM FLOODING, AUSTRALIA,
Macquarie Univ., North Ryde (Australia). School of Earth Sciences.
S. J. Riley.
Water Resources Bulletin, Vol 17, No 3, p 361-366, June, 1981. 2 Fig, 5 Tab, 20 Ref.

Descriptors: *Dams, *Flood frequency, *Rainfall, Flood peak, Flood recurrence interval, Warragamba Dam, Hawkesbury River, *Australia, Precipitation.

The Warragamba Dam has negligible effect on downstream flooding in the Hawkesbury River catchment, eastern Australia, according to examination of 100 years of flood records at Windsor. This dam, completed in 1960, includes 62% of the catchment and has a capacity of 2092 million cu meters. Four smaller dams (81-214 million cu meters) were built on the river in 1907, 1926, 1927, and 1935. For statistical analysis, the 100 year period was divided into five 20 year periods to detect the effect of these dams. It was established that there were no significant changes in channel depth or configuration during the past 100 years. Flood frequency was twice as great for 1939-1978 (26 yearly) as for 1879-1938 (10-17 yearly), reflecting the well-known change in seasonality and increase in total annual precipitation starting in 1940. This increased rainfall is the most important variable in determining flood regime. No significant differences in mean peak flood height or variance of flood heights were seen among the five 20 year periods. (Cassar-FRC)
W82-02425

POINT PROCESS MODELS OF RAINFALL,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W82-02452

RAINFALL-RUNOFF MODELING AND PRELIMINARY REGIONAL FLOOD CHARACTERISTICS OF SMALL RURAL WATERSHEDS IN THE ARKANSAS RIVER BASIN IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W82-02462

PRELIMINARY APPRAISAL OF EPHEMERAL-STREAMFLOW CHARACTERISTICS AS RELATED TO DRAINAGE AREA, ACTIVE-CHANNEL WIDTH, AND SOILS IN NORTHWESTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
H. R. Hejl, Jr.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Prices: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-64, 1980. 15 p, 1 Fig, 3 Tab, 6 Ref.

Descriptors: *Surface drainage, *Flood discharge, *Ephemeral streams, *Flood forecasting, *Mathematical studies, Regression analysis, Channel morphology, Gaging stations, Estimating, Runoff, Flood recurrence interval, *New Mexico, San Juan Basin.

Regression equations are presented to predict ephemeral streamflow characteristics in the San Juan Basin in northwestern New Mexico. The standard error of estimate for predicting runoff for water year 1978 using drainage area as the independent variable was 152 percent. Indications are that reliable equations for predicating annual runoff can be developed and the standard error of estimate might be reduced significantly with additional years of record. The coefficient of regression when relating drainage area to runoff for water year 1978 was significant at the 1-percent level. Preliminary results also indicate it is feasible to predict streamflow characteristics using hyrologic soil-group classifications based on runoff potential. The standard error of estimate for predicting peak discharges with recurrence intervals of 2, 5, 10, 25, 50, and 100 years using active-channel width as the independent variable averaged about 50 percent, and the regression coefficient was significant at the 1-percent level. Using drainage area to predict peak discharges resulted in a standard error of estimate that averaged about 60 percent and a regression coefficient significant at the 5-percent level. The standard error of estimate averaged about 45 percent when active-channel width and drainage area were related to peak discharges in multiple regression analyses. (USGS)
W82-02476

HYDRAULIC ANALYSIS OF CHENANGO RIVER, BROOME COUNTY, NEW YORK, IN RELATION TO STATE HIGHWAY PLAN,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 4C.
W82-02477

FLOOD OF NOVEMBER 26-27, 1979, IN ESSEX COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. J. Zembrzuski, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $1.75, Microfiche $3.50. Geological Survey Open-File Report 80-1024, 1981. 10 p, 3 Tab, 4 Fig, 5 Ref.

Descriptors: *Floods, Flash floods, *Storm runoff, *Washouts, Streams, Flood damage, Flood peak, Flood recurrence interval, Flood frequency, Indirect flood measurement, Flood data, *New York, *Essex County.

On November 26-27, 1979, flash flooding of several streams in Essex County, N.Y., resulted in five deaths and millions of dollars of property damage. The most severe flooding was in the headwaters of the Bouquet and East Branch Ausable river basins. Peak discharge of The Branch, the Bouquet River tributary on which a section of highway washed out, was 6,600 cubic feet per second at a measurement site 1 mile west of Elizabethtown. The exceedance probability of this discharge is estimated to be less than 0.01 (recurrence interval greater than 100 years). (USGS)
W82-02483

FLOODS OF MARCH 1978 IN THE MAUMEE RIVER BASIN, NORTHEASTERN INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. E. Hoggatt.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $2.50, Microfiche $3.50. Geological Survey Open-File Report 81-695, 1981. 81 p, 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Floods, *Flood damage, Flood peak, *Flood data, Flood discharge, Flood recurrence interval, Flood flow, Precipitation, *Indiana, *Maumee River basin, *Fort Wayne.

Floods in the Maumee River basin in northeastern Indiana in March 1978 resulted in heavy damage in Fort Wayne and surrounding areas. Flood damage in Fort Wayne was estimated by the Mayor to be 11 million dollars. Approximately 15 percent of the city was inundated, and 2,400 of its 190,000 residents were forced to leave their homes. The estimate of damage in Adams and Allen Counties by Civil Defense officials was 44 million dollars. The Maumee River at New Haven exceeded the peak stage of record, 21.4 feet, by 2.2 feet. The peak discharge at this stream-gaging station, 22,400 cubic feet per second, was about equal to that of a 75-year flood. Recurrence intervals of peak flows on streams tributary to the Maumee River ranged from 5 to 50 years. Records of peak and daily discharges and some precipitation data are given in this report. (USGS)
W82-02485

SELECTING SEASONAL STREAMFLOW MODELS,
Idaho Univ., Moscow. Dept. of Electrical Engineering.
T. B. Cline.
Water Resources Research, Vol 17, No 4, p 975-984, August, 1981. 8 Fig, 7 Tab, 28 Ref. OWRT-A-065-IDA(2).

Descriptors: *Streamflow forecasting, *Model studies, *Boise River, Idaho, Correlation analysis.

Akaike's information criterion (AIC) and Kashyap's posterior probability criterion (PP) are useful in selecting a final candidate from a group of seasonal autoregressive integrated moving average models for forecasting streamflows. The criteria solve the problem of comparing models with different transformations of the observations. Monthly average streamflow on the Boise River, Idaho, is modeled using the described criteria. Results indicate that no single model selection method should be used for model building. Ideally, the correlation methods should be used for preliminary model identification and either the AIC or PP used to choose the final model. They are especially valuable for choosing between transformational classes and for resolving the trade-off between goodness of fit and parsimony. Some guidelines are: (1) for seasonal models, count parameter redundances due to cross products as unknown parameters, and (2) validate parameter estimates and candidate structures before making a final selection on the basis of minimizing the crierion. For moderate sample sizes (600 in this study) the difference between AIC and PP is consistent but small, and should not affect the ranking of candidate models. (Cassar-FRC)
W82-02502

HYDRAULICS OF FLOW AND SEDIMENT TRANSPORT IN THE KANKAKEE RIVER IN ILLINOIS,
Illinois State Water Survey, Champaign.
For primary bibliographic entry see Field 2J.
W82-02512

COMPARISON OF BEHAVIOR OF TWO SUBBASINS IN THE TURTLE CREEK DRAINAGE SYSTEM,
Beloit Coll., WI. Dept. of Geology.
For primary bibliographic entry see Field 2A.
W82-02528

MATHEMATICAL MODELS OF WATER YIELD WITH PARTICULAR REFERENCE TO MISSISSIPPI WATERSHEDS, INTERIM REPORT NO. 2: MATHEMATICAL MODELING OF WATERSHED YIELD,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W82-02533

THE EFFECT OF CURRENT ON THE DISTRIBUTION OF DIATOMS SETTLING ON SUBMERGED GLASS SLIDES,
For primary bibliographic entry see Field 7B.
W82-02567

2F. Groundwater

PROCEEDINGS AND RECOMMENDATIONS OF THE WORKSHOP ON GROUNDWATER PROBLEMS IN THE OHIO RIVER BASIN, APRIL 28-29, 1981. CINCINNATI, OHIO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153354, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, Purdue University, West Lafayette, Indiana, Report, 1981. 104 p, 22 Fig, 20 Tab, Append. OWRT-C-90054-T(9615)(2).

Descriptors: *Surface-groundwater relations, *Groundwater potential, *Ohio River Basin, Aquifer, Groundwater management, Groundwater pollution, Symposium.

The workshop was an outgrowth of an activity by the Ohio River Basin Commission's Task Force on ground and surface water interrelationships. The task force, composed of representatives of the eleven Ohio River Basin states' Water Resources Research Centers, organized the workshop to provide an opportunity for state and federal water resource professionals to come together with the university community and representatives of industry and the private sector to examine state and regional ground water management problems and needs in the 160,000 square-mile Ohio River Basin drainage area. Presentations by state, federal, university and industry representatives focused on identification and discussion of the full range of state and regional technical and policy-related ground water management problems, provided information on related federal agency programs and research activities, and examined developments in ground water quality and quantity modeling. The principal activity of the workshop surrounded the four work group sessions held to discuss the details of specific needs and problems and to develop recommendations for action. The work groups were made up of (1) legal/institutional, (2) monitoring, (3) methods, and (4) groundwater interrelationship. The proceedings presents recommendations for action by the Commission or subsequent river basin institution.
W82-02106

THE GROUND WATER FLOW SYSTEM IN THE VICINITY OF MARCO ISLAND, FLORIDA,
Geraghty and Miller, Inc., West Palm Beach, FL.
V. P. Amy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 252-263, 4 Fig, 11 Ref.

Descriptors: *Saline water, *Groundwater movement, *Chlorides, *Unconfined aquifers, Artificial lakes, Seawater, Wetlands, Geohydrology, Evaporation, Marco Island area, *Florida.

The planned development of a coastal area near Marco Island includes the creation of a series of interconnecting lakes ranging in depth from a few feet to as much as 30 feet. Construction of these lakes will penetrate the water table aquifer in an area that is a mix of coastal wetlands and uplands. The principal goals of this study were to estimate groundwater input to the property and to investigate fresh-salt ground water relationships in the vicinity of Lake Marco Shores. Data was collected from a variety of sources: an existing network of multi-zone monitor wells on the property, new multi-zone wells, exploratory and observation wells installed by the South Florida Waters Management District, and published reports. The Pamlico Sand and the underlying limestone formations respond hydrologically as a single unit, forming a water table aquifer in the area. With the exception of the sample from well 7, water from wells tapping the principal water-bearing zone and the deep portion of the lake contained chlorides well in excess of the normal concentration of sea water. Water from wells tapping the principal zone north of the Belle Meade Grade in salty to brackish. Proceedings northeast from the Belle Meade Grade, the chloride concentration of the ground water lessens. South of the grade, water from the shallow wells ranges from 616 to 23,100 mg/l, while the shallow portions of the lake had chlorides of 3,661 mg/l. The average groundwater flow was calculated as 39.44 gallons per day per linear foot of aquifer width, or 208,000 gallons per day per linear mile. Evaporation is considered to be one of the mechanisms resulting in the formation of hypersaline groundwater. (Moore-SRC)
W82-02123

AQUIFER RESPONSE DUE TO ZONES OF HIGHER PERMEABILITY AND STORAGE COEFFICIENT,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and K. S. Rathod.
Journal of Hydrology, Vol 50, No 1-3, p 299-316, March, 1981. 11 Fig, 10 Ref.

Descriptors: *Permeability, *Aquifers, *Storage coefficients, *Groundwater movement, Streamflow, Recharge, Groundwater recharge, Groundwater storage, Candover Chalk catchment, Water table, Model studies, United Kingdom, *Surface-groundwater relations.

The groundwater velocities in an aquifer may be several times higher than background levels in regions of higher permeability (for example, fissures). A backward-difference finite-difference approach was developed to study these situations. A steady state problem was used to illustrate the manner in which groundwater recharge flows through the aquifer and enters a stream. the Interaction between storage and flow in an aquifer is complex, as illustrated by a one-dimensional time variant example. It is shown that a partially penetrating river can draw water from the aquifer. The Candover chalk catchment, United Kingdom, is used as an example in the model. Although the equations used do not directly include vertical flow components, the flow analysis of separate zones indicates that vertical flow components exist and are important for understanding aquifer behavior. Thus the standard regional groundwater flow equation stated in terms of transmissivity, takem as an integral of the horizontal permeabilities, infers the existence of vertical components of flow. (Cassar-FRC)
W82-02190

EFFECTS OF WATER-TABLE CONFIGURATION ON SEEPAGE THROUGH LAKEBEDS,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2H.
W82-02281

A TWO-DIMENSIONAL FINITE-ELEMENT SOLUTION SCHEME FOR THE SATURATED-UNSATURATED FLOW WITH APPLICATIONS TO FLOW THROUGH DITCH-DRAINED SOILS,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
A. B. Gureghian.
Journal of Hydrology, Vol 50, No 1-3, p 333-353, March, 1981. 16 Fig, 19 Ref.

Descriptors: *Water table, *Drainage, *Soil water, Aquifers, Ditches, Model studies, *Groundwater movement, Saturated flow, Unsaturated flow.

A 2-dimensional Galerkin finite element model was designed to predict the steady and transient saturated-unsaturated movement of water in homogeneous and nonhomogeneous ditch-drained aquifers. The parallel, equidistant ditches extend to an impermeable floor. A method for handling the nonhomogeneous boundary conditions at the seepage face for a quasi-correct prediction of the water table is discussed. Examples are presented and compared with numerical solutions for cases with incident rainfall under steady state conditions for homogeneous and layered soils. (Cassar-FRC)
W82-02283

THERMAL CONVECTION IN A NONHOMOGENEOUS AQUIFER,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
H. Rubin.
Journal of Hydrology, Vol 50, No 1-3, p 317-331, March, 1981. 7 Fig, 14 Ref.

Descriptors: *Aquifers, *Homogeneity, *Thermal properties, Thermal convection, Permeability, Geothermal studies, Heat transfer, Convection, Thermal conductivity, *Nonhomogeneous aquifers.

The effect of aquifer nonhomogeneity on thermal convection was investigated mathematically. Nonhomogeneity leads to variations in permeability and thermal conductivity of the aquifer. A large temperature difference between bottom and top of the aquifer can induce nonhomogeneity by affecting fluid viscosity and thermal conductivity of the saturated formation. Heat transfer, studied by numerical simulations, showed that the structure of the flow field and the dimensionless parameters characterizing the thermal convection may vary considerably due to aquifer nonhomogeneity. (Cassar-FRC)
W82-02288

EFFECT OF COLD WATER ENTRY INTO A LIQUID-DOMINATED TWO-PHASE GEOTHERMAL RESERVOIR,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
M. A. Grant.
Water Resources Research, Vol 17, No 4, p 1033-1043, August, 1981. 6 Fig, 1 Tab, 28 Ref.

Descriptors: *Geothermal studies, *Injection, *Resources development, Geothermal resources, Pressure distribution, Saturation, Stability.

An analysis is presented of the effect of fluid withdrawal and injection into a two-phase geothermal reservoir, considering pure water-steam mixtures only. A model is presented of the geothermal reservoir matrix treated as a homogeneous medium with injected fluid mixing fully into two-phase fluid. A pressure drop is caused by withdrawal of fluid. Fluid injection causes a pressure change dependent on the fluid enthalpy and rate of injection. For cold fluid injection this is nearly always a pressure drop. The pressure disturbance and change in saturation that occur near the injection point spread through the system. A stability criterion is derived which stabilizes the two-phase fluid. Cold water intrusions occur during exploitation or can occur naturally. For example, at Wairakei, exploitation produced a sub-hydrostatic pressure profile in the two-phase zone and the vapor dominated zone. The two-phase condition is usually absent in the natural state. (Small-FRC)
W82-02314

GEOTHERMAL ENERGY: AN OLD ALLY,
E. Laszlo.
Ambio, Vol 10, No 5, p 248-249, 1981. 2 Fig.

Descriptors: *Geothermal power, *Reviews, Water pollution sources, Sulfates, Chlorides, Silica, Drilling, Hot springs, Powerplants, *Thermal powerplants.

The first geothermal power production experiment began in Larderello, Italy in 1904, with steam emerging from fissures in the earth being used to generate electricity. By 1980 the total installed power capacity from geothermal sources in the world amounted to 2.5 GW. Geothermal energy arises from the radioactive decay of an isotope of potassium and other elements spread about in the earth's crust. As groundwater rarely circulates naturally below 4000 meters deep, the temperature of geothermal hot water and steam is usually below 300 degrees C, and is normally much less. Drilling and heat extraction are currently economically profitable down to about 3000 meters, but techniques should improve that figure down to as much as 5000 meters depth, thus increasing the reachable supply of available energy. High thermal gradients that ensure a heat flow to the surface are found in about 10% of the land area of the world. Low-temperature thermal energy has several uses and has the added benefit of producing only minor environmental effects compared to other energy sources when used. Even so, groundwater may become polluted with chlorides, sulfates and carbonates or silica. If the casting of geothermal boreholes is badly installed, the danger of connecting the geothermal aquifer with a freshwater horizon is greatly increased. Further problems include the release of sulfurous gases to the atmosphere and the discharge of warm water to rivers. The potential of geothermal energy would be greatly increased if heat were to be extracted from hot, dry rocks which do not naturally contain water. (Baker-FRC)
W82-02333

UNSTEADY FREE FLOW TO A DITCH FROM AN ARTESIAN AQUIFER,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
M. A. Gill.
Journal of Hydrology, Vol 52, No 1/2, p 39-45, June, 1981. 4 Fig, 4 Ref.

Descriptors: *Flow, *Confined aquifers, *Groundwater movement, Ditches, Steady flow, Unsteady flow, Mathematical studies, Water level, Wells, Artesian pressure.

A mathematical model has been formulated for a freely flowing ditch under artesian conditions. A solution is obtained for the unsteady condition of flow which reduces to steady state after the lapse of theoretical infinite time. A formula for transient discharge is also given. Such a problem was first introduced in 1969 to predict the future groundwater resources of the African Sahara. At the time a system of wells was considered to be arranged in a line and well spacing was assumed to be small, so that the line of wells was replaced by a two-dimensional ditch for the sake of analysis. A similar problem was formulated in which the water level was suddenly raised at one end of the ditch while at the other end the pressure remained unaltered. In practice, the raising of water level or pressure at one end can be visualized to have been caused by the construction of a dam. The solution proposed in 1969 for the ditch problem was found inconsistent with some of the initial and boundary conditions used. The correct solution is given in this brief communication. (Baker-FRC)
W82-02369

ORIGIN OF ISOTOPIC AND GEOCHEMICAL RATIO GRADIENTS IN KARST WATER OF THE JURA MOUNTAINS. (SUR L'ORIGINE DES GRADIENTS DE TENEURS ISOTOPIQUES ET GEOCHIMIQUES DANS LES EAUX KARSTIQUES DU JURA (FRANCE)),
Franche-Comte Univ., Besancon (France). Lab. de Geologie Structurale et Appliquee.
J. Mudry.
Journal of Hydrology, Vol 50, No 1-3, p 167-178, March, 1981. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Chemical properties, *Geochemistry, *Karst hydrology, Groundwater, Isotope studies, *Jura Mountains, *France, Aquifers, Conductivity.

Isotopic gradients (O18 and tritium) and geochemical gradients (temperature, conductivity, silica, Ca, Mg, Na, K, Cl, sulfates, bicarbonates, and nitrates) were studied in the karst water of the Jura Mountains, France. Climate affected the emergent water temperature and O18 content. Lithology and pollution were responsible for geochemical gradients: K and sulfates deriving from marls and Mg from dolomites. Gradients connected with hydrodynamic properties (ionic activity, silica, and tritium) differed in aquifers with high transmissivity and aquifers with long residence time. Further, they closely followed the geologic structure (a folded zone with large structural gradient and weakly inclined table land). (Cassar-FRC)
W82-02422

THE IMPORTANCE OF DRIFT DEPOSIT INFLUENCES ON THE HYDROGEOLOGY OF MAJOR BRITISH AQUIFERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
J. W. Lloyd.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 346-356, July, 1980. 8 Fig, 16 Ref.

Descriptors: *Hydrogeology, *Aquifers, *Deposition, *Groundwater, Base flow, Geological formations, Wells, Stratigraphy, Rivers, Sand, Gravel, Hydraulic properties, Zones, Field tests, *Great Britain.

The role of drift deposits in major aquifer hydrogeology is examined. Examples are given, indicating important hydrogeological influences exercised by drift deposits on the Chalk aquifer in Essex, Norfolk, and Lincolnshire and on the Triassic Sandstone aquifer in Lancashire and Yorkshire. In drift successions such as in Essex the frequency of lithological change in the vertical sequence is so great that the bulk horizontal permeability is orders of magnitude greater than the bulk vertical permeability. In consequence, groundwater transfer is predominantly horizontal. The gravels exercise an important storage function for the Chalk aquifer. Blow-wells are present in the Lincolnshire aquifer. These are artesian springs which enhance permeability while providing hydraulic control on saline waters. Indirect recharge through Pleistocene sands and gravels in the drift is a significant mechanism in the Triassic sandstones. Permeable drift should be considered in assessments of recharge and supply well locations. (Titus-FRC)
W82-02437

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1981,
Geological Survey, Austin, TX. Water Resources Div.
R. K. Gabrysch.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $2.25, Microfiche $1.00. Geological Survey Open-File Report 81-676, June, 1981. 2 Sheets, 1 Ref.

Descriptors: *Groundwater, *Wells, *Water level, *Potentiometric level, Water level fluctuations, Maps, Contours, Aquifers, *Texas, Houston area, Chicot aquifer, Evangeline aquifer.

Two maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1981 and (2) the Evangeline aquifer, spring 1981. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces. These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads. (USGS)
W82-02459

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1981,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02464

SIMULATION OF AN AQUIFER TEST ON THE TESUQUE PUEBLO GRANT, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
G. A. Hearne.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Papcer copy $6.00, Microfiche $3.50. Geological Survey Open-File Report 80-1022, September, 1980. 41 p, 17 Fig, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Aquifer testing, *Simulation, *Water quality, Aquifer characteristics, Geohydrology, Wells, Withdrawal, Hydraulic conductivity, Specific yield, Storage, Chemical analysis, *New Mexico, Tesuque Formation.

An aquifer test was designed and conducted in the anisotropic dipping beds of the Tesuque Formation on the Tesuque Pueblo Grant, N.M. The three-dimensional digital model used to analyze the test approximated the response to the test. The analysis of the geohydrology of the test site in combination with the model calibration has provided estimates of average aquifer characteristics for the group of beds penetrated at the test site; the hydraulic conductivity parallel to the beds is about 2 feet per day, the hydraulic conductivity normal to the beds is about 0.0001 foot per day or lower, the specific yield is about 0.15, and the specific storage is about 0.000002 per foot. (USGS)
W82-02465

WATER LEVELS IN BEDROCK AQUIFERS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
W. L. Bradford.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $19.75, Microfiche $3.50. Geological Survey Open-File Report 81-627, May, 1981. 152 p, 3 Fig, 1 Tab.

Descriptors: *Groundwater, *Water level, *Wells, *Data collections, Bedrock, Aquifers, Water supply, Confined groundwater, Observation wells, Sites, Hydrographs, *South Dakota.

This report on water levels in bedrock aquifers in South Dakota is the result of a continuing investigation begun in 1959 by the U.S. Geological Survey in cooperation with the South Dakota Department of Water and Natural Resources. The purpose of the investigation is to collect data on the artesian water supply in the bedrock aquifers and to present these data in data reports that will aid in planning the use and conservation of water from these aquifers in South Dakota. The locations of wells were data have been collected are included. (USGS)
W82-02466

GROUND-WATER DATA FOR MICHIGAN 1980,
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $7.75, Microfiche $3.50. Geological Survey Open-File Report 81-811, 1981. 57 p, 4 Fig, 3 Tab, 88 Ref.

Descriptors: *Groundwater, *Aquifers, *Water quality, *Wells, *Water level, Water yield, Water use, Well data, Geohydrology, Hydrographs, Water level fluctuations, Water analysis, Chemical analysis, *Michigan.

This report summarizes data on water levels in 133 observation wells and provides information on water quality, well locations, depths, altitudes, and aquifers that they tap. Tabulated data include extremes of water levels for 1980 and for the period of record. Also tabulated is the pumpage of most major ground-water users in Michigan and quality data on selected wells sampled during 1980. Ground water levels were below average in the southcentral and southeastern part of the State, but above average elsewhere. (USGS)
W82-02467

WATER RESOURCES OF THE KISATCHIE WELL-FIELD AREA NEAR ALEXANDRIA, LOUISIANA,
Geological Survey, Alexandria, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02480

THE AVAILABILITY OF GROUND WATER IN WESTERN MONTGOMERY COUNTY, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
E. G. Otton.
Maryland Geological Survey Report of Investigations No 34, 1981. 76 p, 30 Fig, 13 Tab, 35 Ref.

Descriptors: *Groundwater availability, *Hydrologic budget, *Water table, *Aquifers, Crystalline rocks, Sedimentary rocks, Groundwater movement, Geology, Observation wells, Water level, Recharge, Potentiometric level, Well yield, Precipitation, Water use, Water quality, Water management, *Maryland, *Montgomery County.

Western Montgomery County, Md., is underlain by phyllite and schist and by shale, siltstone, and sandstone. Water occurs chiefly in fractures and crevices in the rocks under water-table or modified artesian conditions. The source of all ground water is local precipitation, amounting annually to about 42 inches. Yields of several hundred wells range

from a few to 900 gallons per minute. Specific capacity, a better index of well productivity, ranges widely. The median specific capacity of 21 crystalline-rock wells is 0.18 gallons per minute per foot, and the median specific capacity of 80 wells in the consolidated sediments is 0.15, suggesting little significant difference between the two major rock types. Median transmissivity of the crystalline rocks is 35 square feet per day and the median transmissivity of the Triassic sediment is 17 square feet per day. Storage coefficients range widely, but the mean value for the Triassic sediment at the Poolesville well field is about 0.01. In 1978, well pumpage at the National Institute of Health Animal Center averaged 28,000 gallons per day; pumpage from four wells at Poolesville during 1978 averaged 246,000 gallons per day. Groundwater use in the remainder of the area is estimated to have been 250,000 gallons per day. Chemical quality of the water is suitable for most uses. Water from the crystalline rocks is mildly acidic and soft and water from the Triassic sediments is commonly mildly alkaline and has a greater hardness. Because of the relatively thin soil zone and the fractured nature of the underlying rocks, chances of polluting the aquifer are relatively great. Possible pollutants might be septic-tank effluent, road salt, chemical fertilizers, insecticides, and herbicides. (USGS)
W82-02481

GROUND-WATER-LEVEL MONITORING NETWORK, HOLLISTER AND SAN JUAN VALLEYS, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W82-02487

SELECTED HYDROGEOLOGIC DATA FROM THE JUDITH BASIN, CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02490

ALTITUDE OF THE WATER TABLE IN THE ALLUVIAL AND OTHER SHALLOW AQUIFERS ALONG THE COLORADO RIVER NEAR LA GRANGE, TEXAS, DECEMBER 1980,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02491

ASSESSMENT OF EIGHTEEN PUBLIC GROUNDWATER SUPPLIES IN ILLINOIS,
Illinois State Geological Survey, Champaign.
R. W. Ringler, R. D. Brower, H. A. Wehrmann, A. P. Visocky, and C. B. Burris.
Illinois Institute of Natural Resources State Water Survey Division Contract Report No 237, July 31, 1980. 185 p. 87 Fig, 13 Tab, 5 Ref.

Descriptors: *Aquifers, *Pumpage, *Geohydrology, Groundwater storage, Data collections, Areal hydrology, Geography, Water-bearing formations, Optimal yield, Water supply development, *Aquifer management, Groundwater availability, *Illinois.

Aquifers in Illinois furnish approximately 233 mgd of water to 677 public water supplies outside the six-county area of northeastern Illinois. A total of 42 supplies known to have experienced difficulty recently in meeting water demands were selected for a detailed study of quantities pumped, aquifers developed, water resource availability, and anticipated water demand. Twenty-four were covered in an earlier report and eighteen are described here. Supplies were assessed according to the following criteria: (1) adequate supplies were those that usually required 10 hours or less pumpage to produce average daily consumption; (2) marginal supplies were those that required 10-18 hours of pumpage, or consisted of several wells with pumping rates of less than 30 gpm; (3) deficient supplies were those that required more than 18 hours, were shallow and limited in areal extent, or indicated need of additional sources of water. The detailed area-by-area narratives include geographic and geologic descriptions of the communities and their groundwater supplies, along with estimates of individual aquifer sustained yields. The most favorable groundwater conditions are in the northern third and southern tip of the state. In the central part of the state, major aquifers are sand and gravel deposits in the Mississippi and Illinois River Valleys and the buried bedrock valleys of the Mahomet, Wabash, Ohio, Kaskaskia, and Embarras rivers. (Garrison-Omniplan)
W82-02510

GROUND WATER IN WASHINGTON,
Washington State Univ., Pullman. Water Research Center.
L. J. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157892, Price codes: A03 in paper copy, A01 in microfiche. Report 40, September, 1981. 44 p, 10 Fig, 1 Tab. OWRT-A-999-WASH(7), 14-34-0001-1151.

Descriptors: *Washington, *Groundwater, *Aquifer characteristics, *Irrigation, Drawdown, Surface-groundwater relations, Water quality, Groundwater pollution, Saline water intrusion, Reviews.

This report is not intended to be a comprehensive report on ground water in the State of Washington. Nor does it represent the results of original research. Rather, it is a review of basic groundwater information for the State and a summary of some of the more serious problems occurring and anticipated in the State. Ground water is an important source of water in the State. In the more arid eastern part of the State, ground water is a major source of irrigation water for many farmers. In some of the more heavily irrigated areas, withdrawals of ground water now exceed the rate of recharge, creating serious problems as a result of the decline of ground-water levels in those areas. Throughout the State, people in rural areas depend on near surface ground water as a source of potable water. In recent years, increased concerns about protecting the integrity of the ground-water resource has fostered an increase in research on ground-water quality and protection, particularly with regard to waste disposal. There are many areas of concern to people working with the ground-water resources in the State of Washington that have either not been addressed in this report or discussed only briefly. These areas include; ground-water law and management, Indian and federal-reserved water rights, and the effects of mining and oil and gas exploration on groundwater quality. Hopefully, this report will help to point out the need for continuing and expanding research of the ground-water resources of the State.
W82-02536

INVESTIGATIONS OF HIGH GROUNDWATER IN POLSON TERMINAL MORAINE,
Montana Univ., Missoula. School of Geology.
G. A. Kennett, and R. R. Curry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157918, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 116, Bozeman, August, 1981. 33 p, 7 Fig, 25 Ref, 14 Append. OWRT-A-119-MONT(1), 14-34-0001-9028.

Descriptors: *Groundwater, *Groundwater movement, Glacial aquifers, Glacial soils, *Moraines, Permeability, Porosity, Planning, Land development, Water table fluctuations, Water level, *Polson Moraine, Flathead Lake, Pablo Reservoir, *Montana.

High groundwater areas in Polson, Montana, are located approximately 1 mile north of a terminal moraine and 3 miles north of a storage reservoir constructed in glacial outwash. The complexities of glacially deposited material and its associated permeabilities and porosities affect groundwater movement, shrinkswell of soils and soil drainage. The intensive development of regions south of Polson will need to address potential problems relating to high groundwater. (Hunt-Mont)
W82-02538

GEOTHERMALLY POWERED FOOD-PROCESSING SYSTEMS.
For primary bibliographic entry see Field 3E.
W82-02543

REGIONAL HYDROGEOLOGIC CONCEPTS OF HOMOCLINAL FLANKS,
H. E. LeGrand, and W. A. Pettyjohn.
Ground Water, Vol 19, No 3, p 303-310, May/June, 1981. 5 Fig, 14 Ref.

Descriptors: *Homoclinal flanks, *Geohydrology, *Consequent streams, Geological formations, Artesian springs, Artesian aquifers, Thermal springs, Springs, Sedimentary rocks, Coastal plains, Coastal streams, Topography, Permeability, Aquifer characteristics, Water table aquifers, Streams, Savannah River, Georgia, Aquitards, Cone of depression, Stream discharge, Structural geology, Geomorphology, Groundwater divide, *Groundwater movement, Groundwater runoff.

Homoclinal flanks, sedimentary rocks with minimum deformation, are widwspread and common hydrogeological systems. They are characterized by alternating permeable and impermeable formations, which influence regional groundwater and surface water systems in distinctive ways. Groundwater and surface water in a homoclinal flank are related by four factors: (1) agrologic structure (slightly inclined), (2) distributed of permeability (alternating bands), (3) topography (Head differences to allow water to move), and (4) climate (only humid and semiarid regions are involved). Many of the major artesian systems are associated with homoclinal flanks. Where streams cut into artesian aquifers, discharge to the stream can be considerable. It is the upper artesian aquifers which most greatly influence the hydrology of the system underlying a homoclinal flank, because water moves very slowly (several meters per century) in the lower zones. Consequent streams are especislly significant. A natural cone of depression is formed at the location of a concentrated discharge area. At varying distances downstream is a stagnation zone or small groundwater divide. An example of a consequent stream is the Savannah river, Georgia. Aquifers in homoclinal flanks may feature thermal springs and artesian springs if a sufficient dip is present. The geological setting of stream stretches may shed light on the behavior of groundwater doscjarge into streams, whereas streamflow data alone is insufficient. (Cassar-FRC)
W82-02548

THE USE OF GROUND-WATER FLOW MODELS FOR ESTIMATING LAKE SEEPAGE RATES,
Geological Survey, Iowa city, IA.
J. A. Munter, and M. P. Anderson.
Ground Water, Vol 19, No 6, p 608-616, November/December, 1981. 11 Fig, 1 Tab, 13 Ref.

Descriptors: *Seepage, *Hydraulic conductivity, *Model studies, *Groundwater movement, Lakes, Bass Lake, Nepco Lake, Wisconsin, Lake sediments, Sediments, Aquifers, Estimating, Lake seepage rate.

Two- and three-dimensional groundwater flow models were developed to estimate seepage rates for Bass Lake and Nepco Lake, wisconsin. Bass Lake, groundwater controlled with no surface water inlet or outlet, was described by a two-dimensional profile model. Results showed that the ratio of horizontal to vertical hydraulic conductivity of the aquifer around the lake is related to both the magnitude of vertical hydraulic gradients near the lake and the distribution of seepage from the lake as a function of distance from the shore. The presence of fne-grained sediments in the littoral area can have a significant effect on lake seepage rates, but the presence or absence of fine sediments in the deep parts of the lake is relatively unimportant. Nepco Lake, created by construction of an

earthen dam, has an anomalous groundwater flow system. A three-dimensional model was far superior to a two-dimensional model for simulating the flow system around this lake. It showed that much of the lake bottom loses water. The three-dimensional model produces a much lower water table slope at a point where the influence of two creeks, receiving groundwater discharge, is noticeable. (Cassar-FRC)
W82-02549

SUBDOMAIN INTEGRATION MODEL OF GROUND-WATER FLOW,
California Univ., Irvine. School of Engineering.
T. V. Hromadka, II, and G. L. Guymon.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil engineers, Vol 107, No IR2, p 187-195, June, 1981. 5 Fig, 12 Ref.

Descriptors: *Groundwater, *Mathematical studies, *Finite element method, *Quantitative analysis, *Piezometric head, Flow, Unconfined aquifer, Porosity, Transmissivity, Aquifer, Mathematical equations, Confined aquifer, systems analysis, Groundwater movement.

The subdomain integration version of the weighted residuals method is applied to the linear and nonlinear equations of one-dimensional confined and unconfined groundwater flow, respectively. The approach used is to determine the spatial coordinates as a function of piezometric or free groundwater surface profiles. A simplified version of the numerical model can be accommodated by current programmable calculators. Good results are obtained when applying the proposed numerical model to the problems considered. However, several simulations were required for each problem tested, progressively reducing timestep sizes until negligible differences in computed results were observed. (Titus-FRC)
W82-02550

2G. Water In Soils

PREDICTION OF THE ADVANCING WETTING FRONT IN BORDER STRIP IRRIGATION,
Nairobi Univ. (Kenya). Dept. of Agricultural Engineering.
A. K. Katyal, and J. W. Kijne.
Irrigation Science, Vol 1, No 3, p 177-184, 1980. 2 Fig, 1 Tab, 16 Ref.

Descriptors: *Border irrigation, *Irrigation, *Soil water, Infiltration, Wetting, Surface irrigation, Mathematical equations, Graphical analysis.

Four methods for predicting the advance of a water front in border irrigation are compared using nine sets of published data. The Katopodes and Strelkoff (1977) method is based on the zero inertia solution and presents graphical solutions in terms of dimensionless parameters. Michael's method (1978) is based on a Laplace transformation of the water balance equation and requires values of gamma functions for solution. The Bishop et al., 1967, method uses a simple water balance equation. A new method described in this paper predicts the advance as a power-law polynomial and gives results for values of the coefficient of the exponential advance equation. The K and S method was superior to all other methods tested. The Bishop method and newly-proposed graphical approaches were fairly accurate and simple to calculate, but are not recommended for predicting advance on the wetting fronts in nearly flat border strips. The Michael method requires the most computation time. Reliable infiltration parameters are necessary for all four methods. (Cassar-FRC)
W82-02309

RELATIONSHIP OF ELECTRICAL DISPERSION TO SOIL PROPERTIES,
Battelle Memorial Inst., Columbus, OH.
For primary bibliographic entry see Field 8D.
W82-02561

2H. Lakes

MEROMIXIS IN A COASTAL ZONE EXCAVATION,
Applied Environmental Services, Marco Island, FL.
C. M. Courtney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 219-231, 8 Fig, 11 Ref.

Descriptors: *Meromictic lakes, *Chemocline, *Mixolimnion, *Monimolimnion, *Artificial lakes, Aquifers, Stratification, Water temperature, Saline water, Storm water, Groundwater movement, Seasonal variation, *Lake Marco, Florida.

Lake Marco Shores was created as a dredge and dragline excavation in 1972, and is of particular interest because of its use as a prototype of additional proposed excavations. Over the period 28 October 1976 to 21 June 1977, seven preliminary profiles of temperature, conductivity, salinity, and dissolved oxygen were conducted in the lake. Observations indicated that Lake Marco Shores was developing a meromictic type of stability composed of three vertical strata: the mixolimnion, the chemocline, and monimolimnion. Because each of the three layers was easily definable by in situ measurement, an intensive sampling program was employed from January to December 1978 to describe changes within these layers over an annual cycle. The chemocline is formed at the depth determined by the relative rates of surface and ground water net inputs, the density difference between the mixolimnion and the monimolimnion, and the amount of energy available for mixing. The seasonal changes in temperature relative to salinity did not permit a turnover of the water column. Results suggest that coastal transition zone excavations in the area of the proposed Marco Island development can become meromictic if they are sufficiently deep so as to intersect the intruding saline ground water and if they intersect seaward discharging surface aquifers. The stability of the lake has permitted the lowest layer to accumulate nutrients, and prevented the expected stimulation of productivity. Such excavated lakes, if properly designed and located in this unique area, may represent an interesting alternative for urban stormwater treatment. (Moore-SRC)
W82-02120

THE EFFECT OF ENVIRONMENTAL FACTORS ON PHYTOPLANKTON GROWTH: TEMPERATURE AND THE INTERACTIONS OF TEMPERATURE WITH NUTRIENT LIMITATION,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
G. Y. Rhee, and I. J. Gotham.
Limnology and Oceanography, Vol 26, No 4, p 635-648, July, 1981. 12 Fig, 3 Tab, 40 Ref.

Descriptors: *Nutrient requirements, *Temperature, *Phytoplankton, *Growth kinetics, Algae, Scenedesmus, Asterionella, Nitrogen, Phosphorus, Algal growth, Chlorophyll a, *Lakes.

The simultaneous effects of nutrient limitation and suboptimal temperatures on growth and nutrient uptake were investigated using continuous culture techniques and the algae, Scenedesmus sp. and Asterionella formosa. Phytoplankton were also grown with sufficient nutrients to provide a baseline. The combined effects of temperature and nutrient limitation were greater than the sum of the individual effects. Decreasing the temperature increased the cell quotas of limiting and non-limiting nutrients in N- and P- limited cells, i.e., cells required more nutrient at lower temperatures. At constant temperature, cell quotas of limiting nutrients increased with the growth rate and followed a saturation function. The critical temperature (at which the growth rate is determined solely by temperature, unaffected by nutrients) was 9 C for N-limited Scenedesmus growing at 0.5 per day and 12 C for A. Formosa growing at 0.4 per day. The change of cell quota with temperature varied with the type of nutrient. These changes suggest that the ratio at which one limitation changes to the other is higher at suboptimal temperatures. In nutrient-sufficient cultures, cell quotas for C, N, and P and for chlorophyll a concentrations increased with decreasing temperature. The rate of protein synthesis per unit RNA decreased with temperature. Optimal growth range for Scenedesmus was 20-25 C and for A. formosa, 19-20 C. The highest apparent maximum N uptake occurred at 15 C for Scenedesmus growing at 0.5 per day, and for A. formosa growing at 0.4 per day, at 19-20 C. (Cassar-FRC)
W82-02221

SOME TYPES OF TEMPERATURE INVERSION ENCOUNTERED IN A FRESHWATER LAKE WITH SHORT RESIDENCE TIME,
National Water Research Inst., Vancouver (British Columbia). Pacific and Yukon Region.
R. C. Wiegand, and E. C. Carmack.
Limnology and Oceanography, Vol 26, No 3, p 565-571, May, 1981. 3 Fig, 1 Tab, 27 Ref.

Descriptors: *Thermal stratification, *Lakes, *Temperature effects, Mixing, Turbidity, Seasonal variation, *Kamloops Lake, *British Columbia, Water circulation, Temperature inversion.

Temperature inversions in freshwater lakes can be distinguished by lake location, season, and the physical mechanism of generation. A year-long study was made of Kamloops Lake, British Columbia, a short residence time lake whose seasonal circulation patterns are dominated by the Thompson River. Some 1650 temperature/turbidity profiles were taken. About 230 of these exhibited inversions greater than 0.05 deg C and of vertical thickness greater than 1 m. Inversions fell in these general categories: inlet region, turbidity currents, cabbeling, open lake (shear effects), open lake (surface effects), and outlet region (summer). For one example, potential energy considerations were used to calculate the minimum amount of work done on the water column to produce the observed deformation. (Small-FRC)
W82-02224

FREQUENCIES OF DEVELOPMENTAL MORPHS OF CHAOBORUS AMERICANUS IN FOUR FISHLESS BOG LAKES,
Northern Illinois Univ., DeKalb. Dept. of Biological Science.
C. N. Van Ende.
American Midland Naturalist, Vol 105, No 2, p 401-404, April, 1981.

Descriptors: *Zooplankton, *Bogs, *Lakes, *Temperature effects, Wetlands, Midges, Plankton, Population dynamics, Ecology.

Four bog lakes, located at the University of Notre Dame Environmental Research Center, were sampled for fourth instar larvae of the phantom midge Chaoborus americanus. The percentages of fast-developing morphs found were 92.9, 98.3, 19.6 and 39.2 in the different lakes. These values did not correlate with lake temperature regimes. Lake temperatures were, however, correlated with the rate of pupation of fast developing morphs. The inconsistency of the pupation patterns in these lakes suggests that the system is complex and that factors other than the previous spring's weather may be equally important in determining the frequency of morphs in a lake. For example, cannibalism may be important. Community structure may also be significant in determining the amount of cannibalism. (Baker-FRC)
W82-02238

FACTORS CONTRIBUTING TO THE MAINTENANCE OF OLIGOTROPHY IN AN ALPINE GLACIAL MORAINE LAKE (WALLOWA LAKE) IN NORTHEAST OREGON,
Corps of Engineers, Portland, OR.
D. W. Larson.
Northwest Science, Vol 55, No 2, p 95-107, 1981. 1 Fig, 7 Tab, 24 Ref.

Descriptors: *Limnology, *Wallowa Lake, *Oligotrophic lakes, Alpine regions, Water quality, *Oregon, Irrigation effects, Recreation demand, Salmon.

The limnology of Wallowa Lake, Oregon, was studied, and lake quality and eutrophication were investigated by yearly surveys in 1966-1972. Wallowa Lake is fed chiefly by the Wallowa River; it is about 6.5 km long and 1.0 to 1.5 km wide, with a surface area of 7.9 sq km. The lake and the river are relatively unpolluted and do not suffer dense, sustained algae blooms. Concentrations of nitrogen, phosphorus and BOD were found to be relatively low, and dissolved oxygen was abundant. Major ion concentrations, total alkalinity, total hardness, and specific conductivity all were low. The pH was 7.4-7.8 at four stations sampled in June and August, 1973. The lake may experience problems in the future if not managed carefully. It is subjected to intense recreational use. Also, the watershed is relatively barren, with nutrient impoverished soils. The climate is rigorous and the lake has a steep, deep morphometry. Area subdivisions generally lack proper sewage treatment, but sewage inputs are few and widely spaced. Irrigation releases cause nutrient removal by substantial lake drawdown in summer. The lake is replenished with low temperature, low nutrient water, which may contribute to its pristine, oligotrophic environment. (Small-FRC)
W82-02250

METABOLISM OF A FLORIDA LAKE ECOSYSTEM,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
T. D. Fontaine, III, and K. C. Ewel.
Limnology and Oceanography, Vol 26, No 4, p 754-763, 1981. 5 Fig, 2 Tab, 24 Ref.

Descriptors: *Productivity, Respiration, *Aquatic plants, Phytoplankton, Algae, Lakes, *Plankton, *Little Lake Conway, *Florida, Macrophytes, Photosynthesis, Seasonal variation, Tropical regions, Ecosystems.

The ecosystem and plankton metabolism were studied for a year during 1976 in Little Lake Conway, Florida. This lake, part of a multilobed lake system near Orlando, is enriched in nutrients and has an organic bottom sediment and zones of rich macrophyte growth. Ecosystem production and respiration did not vary much throughout the year. Gross production and respiration were 3071 and 3180 g O_2 per sq meter per year, respectively. Plankton accounted for 44% of the gross production and 54% of the annual respiration, submersible macrophytes and epiphyton for the remainder. Maximum productivity in this lake occurred near the hydrosoil. During June-July respiration and production in submersed plants and epiphytes were minimal, possibly due to the higher temperatures. This data does not contradict the hypothesis that cycles of ecosystem gross production and 24-hour respiration become increasingly balanced and synchronous with decreasing latitude. (Cassar-FRC)
W82-02268

THE DILUTION/FLUSHING TECHNIQUE IN LAKE RESTORATION,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch.
Water Resources Bulletin, Vol 17, No 4, p 558-564, August, 1981. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Lake restoration, *Flushing, *Costs, Nutrients, Algae, Rehabilitation, Eutrophication, Moses Lake, Green Lake, *Washington.

The theoretical basis for dilution/flushing techniques is discussed, followed by a summary of results of applications at Moses Lake and Green Lake, Washington. These eutrophic lakes were diluted with water low in nitrogen and phosphorus, and lake nutrient content dropped. Dilution or flushing rates were about 10 times normal during the spring and summer period in Moses Lake and three times the annual rate for Green Lake. Moses Lake experienced a 50% improvement in water quality, and even greater improvement resulted in Green Lake. In this case, the cost of water transport was minimal, but this cost could be very important at a different application site. If only high nutrient water is available for flushing, improvement may still result from algal cell washout and water column instability. Dilution/flushing can be considered as an effective technique for restoring eutrophic lakes, especially if low nutrient water is available. (Small-FRC)
W82-02270

SEASONAL AND DIURNAL FLUCTUATIONS OF OOMYCETE PROAGULE NUMBERS IN THE FREE WATER OF A FRESHWATER LAKE,
Reading Univ. (England). Plant Science Lab.
I. C. Hallett, and M. W. Dick.
Journal of Ecology, Vol 69, No 2, p 671-692, July, 1981. 12 Fig, 5 Tab, 47 Ref.

Descriptors: *Seasonal variation, *Aquatic fungi, *Lakes, Water quality, Microbiological analysis, Diurnal distribution.

The reliability and amplitude of oomycete propagule numbers in a natural environment were determined by constant flow centrifugation. A method of estimating the numbers of fungal propagules using continuous flow centrifugation, pour plating and scanning was tested on samples collected from a small freshwater lake. The loss of viable propagules for zoospores and zoospore cysts ranged from 5 to 26%. In the lake samples, there was a seasonal periodicity in propagule numbers, with maxima in spring, early summer, and autumn. There were diurnal maxima in early afternoon and late evening. No single factor was isolated that could explain the variations. Lakewater zoospores have a short lifespan; thus the per unit volume of zoospores recovered may be indicative of the activity of the fungi. (Small-FRC)
W82-02274

EFFECTS OF WATER-TABLE CONFIGURATION ON SEEPAGE THROUGH LAKEBEDS,
Geological Survey, Denver, CO.
T. C. Winter.
Limnology and Oceanography, Vol 26, No 5, p 925-934, September, 1981. 6 Fig, 18 Ref.

Descriptors: *Water table, Groundwater movement, *Lakes, Mathematical models, *Lake beds, Influent seepage, *Seepage, Wetlands.

The importance of the slope of the water table near a lake and beyond the lake's immediate watershed on the role of groundwater in the hydrologic and chemical balances of lakes was investigated. The finite-difference groundwater flow model of the US Geological Survey was used. The numerical analysis indicated that the slope of the water table beyond a lake's immediate drainage basin, particularly between a water-table mound on the lake's downgradient side and a regional groundwater discharge area, can have a significant effect on seepage. In two hypothetical settings, water-table slopes greater than or equal to 0.010 in this segment of the water table can cause seepage from the lake. Groundwater discharge may be a mechanism for the occurrence of upland-type wetlands near breaks in the water-table slope. In the glacial Lake Agassiz plain in northwestern Minnesota, groundwater discharge occurs along the east edge of the lake plain where the steep water-table slope in the end moraine meets the very low slope of the water table. (Small-FRC)
W82-02281

SUMMER POPULATION FLUCTUATIONS, FEEDING, AND GROWTH OF HYDRA IN AN ARCTIC LAKE,
North Carolina State Univ., Raleigh. Dept. of Zoology.
B. E. Cuker, and S. C. Mozley.
Limnology and Oceanography, Vol 26, No 4, p 697-708, July, 1981. 9 Fig, 22 Ref.

Descriptors: *Hydra, *Arctic, *Population dynamics, Lakes, *Toolik Lake, *Alaska, Invertebrates, Crustaceans, Copepods, Adaptation, Predation.

Population dynamics of Hydra in the rocky littoral zone of Toolik Lake, Alaska, were similar to those of Hydra in temperate lakes with the exception of a higher rate of increase in biomass at comparable temperatures (0.53 mg per mg per day at 10 C and 0.31 mg per mg per day at 11 C). This indicates a metabolic adaptation to Arctic conditions. During the 1977 study, the population density increased from June to a maximum in late July or early August, corresponding to the availability of food (Bosmina and copepods). Although food resources continued to increase in August, Hydra populations stabilized or decreased, probably as a result of predation, displacement by epilithic algae, and/or emigration. The peak population of Hydra (135 per sq meter) consumed 1620 Bosmina per sq m per day, or 12 Bosmina per Hydra per day. This accounted for 10% of the standing crop in the lake. Bosmina comprised 93% of the food found in Hydra guts. (Cassar-FRC)
W82-02287

SOME ANALYSES OF AQUATIC PLANTS AND THEIR WATERS,
Crewe and Alsagar Coll. of Higher Education (England).
K. G. Allenby.
Hydrobiologia, Vol 77, No 2, p 177-189, 1981. 9 Tab, 7 Ref.

Descriptors: *Aquatic plants, *Chemical composition, *Minerals, Water analysis, Chlorides, Sulfates, Phosphates, Potassium, Calcium, Sodium, Nitrogen.

Several inorganic components of internal tissue and external incrustations of aquatic plants and their surrounding waters were determined. Dilute HCl was used to remove the external incrustations. Average analyses were: chloride, 0.76-4.8%; sulfate, 0.70-2.23% (total) and 0.50-1.65% (internal); phosphate, 0.68-2.56% (total) and 1.47-1.83% (internal); Ca, 0.63-3.86% (total) and 0.76-2.24% (internal); Na, 0.44-1.13 (total) and 0.25-1.17% (internal); K, 1.69-3.30% (total) and 0.88-3.1% (internal); and total N, 2.4-4.3%. There was no correlation between concentrations of the minerals in the water and concentrations in the plant for chloride, sulfate, phosphate, Ca, K, or Na. Generally, aquatic species were two to three times higher in chloride, sulfate, and phosphate content than terrestrial species. The average external incrustation was 50% Ca, 19% K, 14% phosphate, 11% sulfate, and 5% Na. (Cassar-FRC)
W82-02293

QUANTITATIVE DIFFERENCES BETWEEN BENTHIC ALGAL COMMUNITIES ALONG A DEPTH GRADIENT IN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
R. J. Stevenson, and E. F. Stoermer.
Journal of Phycology, Vol 17, No 1, p 29-36, March, 1981. 10 Fig, 1 Tab, 27 Ref.

Descriptors: *Algae, *Benthic flora, *Distribution patterns, Lakes, Phytoplankton, *Lake Michigan, Wave action, Cyanophyta, Diatoms, Population density, Water depth, Water analysis, Vertical distribution.

Benthic algae were examined at five depths in eastern Lake Michigan. Three zones were obvious on the basis of community composition, structure, and abundance: shallow (6.5 m), mid-depth (9.1 and 14.6 m), and deep (22.6 and 27.4 m). There was a diverse algal assemblage with 255 taxa representing 36 genera. Only live cells were counted, according to a technique developed as part of this study. It used a mounting medium of high refractive index. Diatoms were dominant, and substantial numbers of blue-green algae were present in the benthic algal communities. The shallow communities showed dominance of benthic species, high diversity, and low abundance, reflecting the disturbance of wave action. The mid-depth communities were also dominated by benthic species and had high diversity, but abundance was high because wave effects were less. The deep communities featured planktonic algae because light intensi-

ty limited growth of benthic species; diversity and abundance were low. (Cassar-FRC)
W82-02299

THE PATTERNED MIRES OF THE RED LAKE PEATLAND, NORTHERN MINNESOTA: VEGETATION, WATER CHEMISTRY, AND LANDFORMS,
Minnesota Univ., Minneapolis. Limnological Research Center.
P. H. Glaser, G. A. Wheeler, E. Gorham, and H. E. Wright, Jr.
Journal of Ecology, Vol 69, No 2, p 575-599, July, 1981. 5 Fig, 2 Tab, 74 Ref.

Descriptors: *Vegetation, *Water quality, *Peat bogs, *Fens, Chemical composition, Hydrogen ion concentration, Conductivity, Calcium, *Red Lake, *Minnesota, Drainage effects.

A study was performed to classify the major vegetational types of the Red Lake Peatland (Minnesota), to determine the relationships of the vegetation to major landforms and their water chemistry, and to investigate the possibility of currently changing vegetational forms. In raised bogs and ovoid islands where waters were of low pH, low Ca(+2) concentration, and low conductivity, two types of vegetation occurred. On strings, flats and teardrop islands which were characterized by high pH, low Ca(+2) concentration, and low conductivity, three types of fen vegetation were found. Poor fens occurred where waters had intermediate pH ranges, Ca(+2) concentrations, and conductivities. Surface drainage seemed to be important in the maintenance of mire patterns, as drainage ditches had localized effects on vegetation and landforms. (Small-FRC)
W82-02300

THE RECOLONIZATION OF LAKE TAHOE BY BOSMINA LONGIROSTRIS: EVALUATING THE IMPORTANCE OF REDUCED MYSIS RELICTA POPULATIONS,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.
Limnology and Oceanography, Vol 26, No 3, p 433-444, May, 1981. 6 Fig, 3 Tab, 30 Ref.

Descriptors: *Zooplankton, *Population dynamics, *Lake Tahoe, Predation, Annual distribution, Aquatic animals, Aquatic populations, *Bosmina longirostris.

Bosmina longirostris reappeared in Lake Tahoe after an absence of more than three years. Demographic analyses and feeding experiments suggested that predation by Mysis relicta, which was introduced to the lake, may have been responsible for Bosmina's decline and disappearance. Bosmina reappeared when there was a reduction in Mysis relicta from about 380/sq m. Other factors including biological and physical influences may have had more to do with the reappearance of Bosmina than the reduction in Mysis. Considerable annual variation occurs in Lake Tahoe plankton dynamics, predator assemblages, and in interactions between the littoral and pelagial. Bosmina may have been reintroduced by wind-induced advection from Emerald Bay. (Small-FRC)
W82-02305

THE EFFECT OF ENVIRONMENTAL FACTORS ON PHYTOPLANKTON GROWTH: LIGHT AND THE INTERACTIONS OF LIGHT WITH NITRATE LIMITATION,
New York State Dept. of Health, Albany. Division of Labs. and Research.
G. Y. Rhee, and I. J. Gotham.
Limnology and Oceanography, Vol 26, No 4, p 649-659, Jul, 1981. 9 Fig, 2 Tab, 26 Ref.

Descriptors: *Nutrient requirements, *Light intensity, *Phytoplankton, *Growth kinetics, Lakes, Algae, Algal growth, Nitrates, Scenedesmus, Fragilaria, Nitrogen, Phosphorus, Chlorophyll a.

The combined effects of light and nutrient limitation in growth of Scenedesmus sp. and Fragilaria crotonensis were studied with continuous culture systems. The combined effects were greater than the sum of the individual effects. Nutrient requirements increased with decreasing irradiance. When N was limiting, the cell quota of the limiting nutrient increased as irradiance decreased for a constant growth rate and subsistence quota. Thus, within a certain range of growth rates, light and nitrogen cell quota can compensate for each other in maintaining the growth rate. When nutrients were not limited, decreasing light below saturation increased the cell quotas of C, N, and P and the chlorophyll a concentration. Cell quotas of nonlimiting nutrients in nutrient-limited cultures are the maximum that can be reached at a given irradiance. (Cassar-FRC)
W82-02331

SUMMER INTERNAL PHOSPHORUS SUPPLIES IN SHAGAWA LAKE, MINNESOTA,
Corvallis Environmental Protection Agency, OH.
For primary bibliographic entry see Field 5B.
W82-02332

PRODUCTIVITY OF FOUR MARSH SITES SURROUNDING LAKE PONTCHARTRAIN, LOUISIANA,
Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.
G. W. Cramer, J. W. Day, Jr., and W. H. Conner.
American Midland Naturalist, Vol 106, No 1, p 65-72, July, 1981. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Marshes, *Primary productivity, *Aquatic plants, Wetlands, Lake Pontchartrain, *Louisiana, Productivity, Nutrients, Spartina, Vegetation, Decomposition, Tidal marshes, Salinity.

Net primary production and nutrient concentrations were studied from February 1978 to March 1979 at Spartina patens marshes near Lake Pontchartrain, Louisiana. The four sites varied in salinity (< 1-4.5 ppt), mean tidal range (0-12 cm), and nutrient levels. Vegetation was harvested over the annual cycle at 3-6 week intervals from five 0.1 sq meter quadrats chosen at random in each marsh. Primary production was calculated at 2541-4411 g dry weight per sq meter per year using Smalley's method based on changes in live and dead standing crop between sampling times and 3053-5509 g dry weight per sq meter per year by the Weigert and Evans method based on weight loss of vegetation exposed in nylon mesh bags. Live standing biomass increased from a low in February at all sites to a peak occurring from as early as June to as late as November, depending on the site. After 6 months 35-47% of the vegetation had decomposed. Higher productivity and decomposition rates occurred at sites with higher nutrient levels and free tidal flushing. Salinity was not a factor in productivity. (Cassar-FRC)
W82-02334

HYPOLIMNETIC AERATION OF A SMALL EUTROPHIC KETTLE LAKE: PHYSICAL AND CHEMICAL CHANGES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5G.
W82-02341

THE THERMAL RESPONSE OF LAKE OHRID, YUGOSLAVIA TO METEOROLOGICAL CONDITIONS,
Michigan Univ., Ann Arbor. Dept. of Geography.
S. I. Outcalt, and H. L. Allen.
Archiv fur Hydrobiologie, Vol 91, No 1, p 181-191, May, 1981. 1 Fig, 17 Ref.

Descriptors: *Temperature gradient, *Water circulation, *Meteorological data collection, Lakes, *Lake Ohrid, *Yugoslavia, Epilimnion, Hypolimnion, Water temperature, Stratification, Thermal stratification, Mixing, Lake circulation, Wind, Model studies.

The thermal regime of Lake Ohrid, Yugoslavia, was modeled from meteorological data (daily sunshine duration, mean daily wind velocity, air temperature, relative humidity, and cloud cover). Predicted data were compared with measured water temperature profiles at 13 depths to 240 m. The model, which uses a simple thermal-diffusion-density mixing algorithm, predicted the thermal regime of the lake to a considerable degree. However, there were significant discrepancies between predicted and measured structures in the epilimnion and thermocline during spring-summer warming, the thermocline depth and epilimnion temperatures being underestimated. The simulated hypolimnion temperatures were several tenths of a degree colder than the observed temperatures. The thermal regime of this lake is probably the product of a thermal-density mixing mechanism similar to the proposed model. Wind mixing does not appear important in establishing the annual thermal regime. (Cassar-FRC)
W82-02342

INFRARED ABSORPTION STUDY OF HUMIC SUBSTANCES FROM LAKE APOPKA SEDIMENT, PLANKTON AND THE SURROUNDING DRAINAGE BASIN,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Engineering and Science.
T. V. Belanger.
Florida Scientist, Vol 44, No 2, p 72-78, 1981. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Eutrophication, *Measuring instruments, Infrared spectroscopy, Spectroscopy, Absorption, Humic acids, Organic matter, Catchment areas, *Plankton, Lakes, *Lake Apopka, *Florida, Muck soils.

Infrared methods were used as a limnological tool to evaluate characteristics of humic substances from bottom sediments and sediment from the watershed surroundng Lake Apopka, 24 km west of Orlando, Florida. The lake is large (12,140 ha) and shallow (2 meters), and was once known for its clear waters and good bass fishing. The lake has become hypereutrophic and is now populated by blue-green algae, floating mats of water hyacinths, shad, and brown bullheads. Unconsolidated silt, muck, and peat cover over 90% of the lake bottom. The muck and decaying organic matter is very flocculent and ranges in depth from 0.3 to 12.3 meters throughout the lake. Most of the soils surrounding the lake are well-drained sands suited for citrus production. A muck farm area is located primarily on the north shore of the lake, below lake level, and was once lake bottom. This muck farm area comprises 7.280 ha of nutrient-rich organic soil devoted to vegetable cropping agriculture. The nutrient rich irrigation water must be periodically pumped from the muck farm into the lake, and has been blamed for much of the lake's rapid deterioration. Infrared absorption spectra of 1540 and 1650 cm(-1) peaks in plankton and lake sediment samples, in addition to other spectral similarities, indicate that plankton is the probable precursor of the lake sediment humic substances. These absorption bands are thought to be due to peptide bonds in protein, with amide I absorption occurring at 1650 and amide II at 1540 cm(-1). The spectra from the muck farm soil and citrus soil differ to a greater extent from the spectrum of the lake sediment than do the plankton spectra. (Baker-FRC)
W82-02348

TROPHIC CHANGES WITHOUT CHANGES IN THE EXTERNAL NUTRIENT LOADING,
Goeteborg Univ. (Sweden). Dept. of Zoology.
L. Henrikson, H. G. Nyman, H. G. Oscarson, and J. A. E. Stenson.
Hydrobiologia, Vol 68, No 3, p 257-263, February, 1980. 7 Fig, 23 Ref.

Descriptors: *Oligotrophic lakes, *Productivity, *Nutrients, Trophic level, Fish, Grazing, Predation, Zooplankton, Phytoplankton, Lilla Stockelidsvatten, *Sweden, *Water quality, Fish removal.

Removal of the fish population from an oligotrophic lake produced biotic changes and abiotic changes which altered water quality parameters in an oligotrophic direction. The dominant zooplankton changed from cladocerans to large copepods;

dominant phytoplanktons changed from smaller to larger species. Abiotic changes from 1973 to 1973 to 1977 were as follows: limnetic primary production, 10.7 to 1.5 mg per cu meter; transparency, 1-3 meters to 4-7 meters; pH, 8 to 7; total phosphorus, 13.5 to 7 micrograms per liter; and total nitrogen, 640 to 450 micrograms per liter. The transparency and pH of a control lake remained stable during the study period, which transparency and pH of a control lake remained stable during the study period, which eliminated the possibility of large scale environmental effects. Some of the reasons for the biotic changes were: the lower productivity of larger-celled phytoplankton compared with smaller-celled phytoplankton, increased grazing pressure from the larger herbivores on the smaller phytoplankton size interval, lowered rate of mineralization via zooplankton, and decreased impact of nutrients from areas outside the pelagic zone. pH decreases resulted from changes in CO_2 content. Transparency increases and N and P decreases reflect the decrease in organic particulate matter. (Cassar-FRC)
W82-02367

WIND-INDUCED MIXING IN STRATIFIED FLUID,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
C. Kranenburg.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY5, p 632-637, May, 1981. 21 Ref.

Descriptors: *Mixing, *Wind, *Stratification, Model studies, Mathematical models, Hypolimnion.

A simple model is presented for mixed-layer deepening caused by wind action at the free surface of a density-stratified fluid. A streamwise pressure gradient is considered; solar radiation, cooling, advection, and Coriolis effects are disregarded. When certain modeling assumptions are used, the turbulent energy equation yields a dimensionless entrainment rate inversely proportional to the overall Richardson number. One of these assumptions, that the net kinetic energy input is proportional to the cube of the friction velocity related to the shear stress exerted by the wind, has been criticized. According to a new assumption, the overall Richardson number was assumed to be constant. The findings obtained may be explained, starting from a two-layer structure of the mixed layer, wherein the upper layer is homogeneous and the lower transition layer displays near-critical conditions, i.e., the turbulence is nearly collapsing. The results obtained from the mathematical considerations agree at least qualitatively with observations, and corroborate the concept that density distributions alone can cause the difference between the layers. The flow in the mixed layer was found to be supercritical. (Cassar-FRC)
W82-02371

INTERACTIONS BETWEEN LUGOL'S FIXATIVE AND ETHYLENE IN THE ACETYLENE-REDUCTION ASSAY FOR NITROGENASE ACTIVITY IN LAKE WATER,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 2K.
W82-02380

TROPHIC STRUCTURE AND ENERGY FLOW IN A TEXAS POND,
PETRA Inc., Denton, TX.
W. M. Childress, L. C. Fitzpatrick, and W. D. Pearson.
Hydrobiologia, Vol 76, No 1/2, p 135-143, 1981. 3 fig, 5 Tab, 33 Ref.

Descriptors: *Trophic level, *Ponds, Energy, Annual distribution, *Texas, Primary productivity, Food chains, Aquatic organisms, Respiration.

The trophic structure of a Texas pond is described, and a general model of energy flow through the community is presented. The pond is located on the southwest edge of Denton, Texas. Water sources are runoff from a 10 ha watershed and a well, 200 meters deep into the Trinity sandstone. Surface area during the study ranged from 8,313 to 10,566 square meters. Mean and maximum depths were 2.5 and 3.5 meters, respectively. Water temperature ranged from 4 to 33 degrees C, with mean of about 20 degrees C. Runoff from an adjacent golf course contained grass clippings, leaves and fertilizers together with dust from a nearby unpaved road, yielding abundant allochthonous materials to the pond. Preliminary work identified four major components of the pond community: primary producers such as algae and vascular plants, microcrustacean zooplankton, benthic invertebrates, and fish. These four major groups were described in terms of energies of consumption, respiration, predation, losses to sediments and decomposers, and emigration. Annual primary production was 7,780 kcal/square meter/year for a production-respiration ratio of 1.49. Climax communities are usually thought to have a production-respiration ratio close to 1.0. A new surplus of about one third of the primary production was apparently deposited on the substrate. Energetics were partitioned into four trophic levels for determination of ecological efficiencies. Resulting efficiencies were 26.6% for primary producers, 4.69% for primary consumers, and 7.34% for secondary consumers. The pond ecosystem had greater energy flow through the upper levels than reported for other systems in the literature. (Baker-FRC)
W82-02397

THE IMPACT OF URBANIZATION ON SEASONAL HYDROLOGIC AND NUTRIENT BUDGETS OF A SMALL NORTH AMERICAN WATERSHED,
Wisconsin Univ.-Madison. Inst. of Environmental Studies.
For primary bibliographic entry see Field 5B.
W82-02400

DIEL CHANGES IN PLANKTON AND WATER CHEMISTRY IN WICKEN BRICKPIT,
Cambridge Univ. (England). Dept. of Applied Biology.
S. A. Corbet, R. M. S. Perrin, D. r. Hartley, P. D. Lancashire, and H. A. F. Mace.
Hydrobiologia, Vol 74, No 3, p 249-271, September, 1980. 10 Fig, 5 Tab, 45 Ref.

Descriptors: *Zooplankton, *Nutrients, *Diel variations, Plankton, Phytoplankton, Ponds, Water quality, Vertical distribution, Migration, Wicken Brickpit, Copepods, Cladocerans, Water depth, Dinobryon, Lake Poukawa, *New Zealand.

Diel variations in plankton activity and water chemistry were studied with water samples taken at 1.5 to 3 hour intervals for a 24 hour period starting at noon (1200 hours) August 1, 1977 at Wicken Fen, Cambridgeshire. Supplemental observations were taken on other dates. The marked variations with depth and time suggest that conclusions based on single water samples should be evaluated with caution. Temperatures at 25 cm ranged from 20C to 24C and at 225 cm, from 17.5 to 18C. Dissolved oxygen at 25 cm was highest at 1820-2230 hours and lowest in the morning; it varied greatly with photosynthetic activity. Dinobryon and dinoflagellates were dominant down to 190 cm and remained within this zone throughout the study. Dinobryon spent the day at 50 cm and at 1800-2100 hours moved 20 cm deeper, ascending again at 0600 to 0900 to the daytime level. Dinoflagellates remained at 50 cm from 1800 to 2400, moving down to 150 cm between 0600 and 0900 hours and rising at midday to 50 cm. Zooplankton, mainly copepods and cladocerans, migrated vertically according to time of day and species. The temporal segregation at a given level implies interspecific competition. Inorganic constituents (ammonium N, total oxidized N, reactive phosphate, and silica) had greater variations at the 225 cm depth than at 25 cm depth. The transient peaks in nutrient concentrations observed near the surface may be attributed to nutrient release by zooplankton feeding at greater depths. Similar results were obtained from a 24 hour study of water in Lake Poukawa, New Zealand, on January 9-10, 1979. (Cassar-FRC)
W82-02411

ON THE TROPHIC STATUS AND CONSERVATION OF KASHMIR LAKES,
Central Inland Fisheries Research Inst., Harwan (India).
For primary bibliographic entry see Field 5C.
W82-02412

PRIMARY PRODUCTIVITY AND TROPHIC STATUS OF A KASHMIR HIMALAYAN LAKE,
Kashmir Univ., Srinagar (India). Dept. of Botany.
M. A. Khan, and D. P. Zutshi.
Hydrobiologia, Vol 68, No 1, p 3-8, January, 1980. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Trophic level, *Lake classification, *Primary productivity, Mesotrophic lakes, Lakes, Himalayan Mountains, Naranbagh Lake, *Kashmir, *India, Phytoplankton, Productivity, Water quality.

Naranbagh Lake (34 degrees 12 min N and 74 degrees 41 min E; altitude 1587 meters; area 24.3 ha) in the Kashmir Himalayan Mountains is still mesotrophic according to the 1975-76 yearly phytoplankton production rates, estimated at 134 g C per sq meter. Primary production of phytoplankton, measured by the C14 technique, ranged from 36 mg C per sq meter per day in December to 906 mg C per sq meter per day in July. Photosynthetic efficiency was 0.02-0.48%. Secchi transparency varied from 1.25 to 4.0 meters, and extinction coefficient, from 0.42 to 1.36. Phosphate levels were 6.5-24.5 micrograms per liter and nitrates, 30-55 micrograms per liter. (Cassar-FRC)
W82-02414

THE MIXING LAYER OF LOCH NESS,
Institute of Oceanographic Sciences, Wormley (England).
S. A. Thorpe, and A. J. Hall.
Journal of Fluid Mechanics, Vol 101, No 4, p 687-703, December, 1980. 6 Fig, 32 Ref.

Descriptors: *Lakes, *Mixing, *Turbulent flow, Thermocline, Water circulation, Weather, Boundary layers, Temperature effects, *Loch Ness, Scotland.

The near-surface mixing layer was examined in one of the largest freshwater lakes in Scotland, Loch Ness. Large-scale coherent structures were identified in the turbulent mixing layer. Data collected by several sensors indicated the presence of downward-moving warm water of near surface origin with greater than average horizontal velocity separated by narrow tilted interfaces or fronts, from slower moving, colder water. Turbulent diffusion is indicated by the presence of frequent inversions in the vertical temperature profiles in the region between the fronts. Local Richardson numbers indicate that the fronts are only marginally unstable, if unstable at all, and it is not clear whether the descent of fluid towards the thermocline at increased speed will so increase the shear that the thermocline will become locally unstable. More careful observations of mixing layers are needed to determine the mechanisms at work. It is clear that in many respects, this mixing layer is similar to the near-surface atmospheric boundary layer. (Small-FRC)
W82-02421

ON THE DYNAMICS OF FEEDING OF YOUNG FISH FROM MOZHAYSK RESERVOIR IN VARIOUS YEARS,
Moscow State Univ. (USSR). Dept. of Ichthyology.
V. D. Spanovskaya, V. A. Grigorash, T. V. Lebedeva, and V. A. Rekubratskiy.
Journal of Ichthyology, Vol 20, No 1, p 74-83, January, 1980. 8 Tab, 15 Ref.

Descriptors: *Reservoirs, *Lakes, *Biomass, Fish, Fish populations, Feeding rates, *Mozhaysk Reservoir, *USSR, Limnology, Fish food.

Qualitative and quantitative changes in the feeding of young fish of the limnophilous association were studied in one of the sections of the Mozhaysk Reservoir in different years. The extent of the

effect of varying biomass in the food supply on the young was also assessed. The study was conducted in Khotilov inlet, which is a spawning ground for many species of fish and the foraging place of their young. It is felt that the behavior of the young of the roach, i.e., their distribution in the inlet at different times of the day, is closely connected with the nature of their feeding. In second-year roach and bream, feeding during the day and night occurs with varying intensity, as a rule decreases during the night. The daily consumption calculated for second-year roach from the Uchinskoye Reservoir in 1958 was 5% of body weight, which was close to that of the roach in the Mozhaysk Reservoir. The species and age composition, abundance and biomass of young fish in one of the inlets of the Mozhaysk Reservoir change in different years due to the appearance of strong year-classes and spawning times. The nature of the daily feeding rhythm, its stability and lability, depend on the amount of food, its accessibility and the ecology of the components constituting it. With the increase in the fish biomass in the inlet, food requirements increase, the influence of the fish on the food supply intensifies, and mechanisms ensuring its fuller use and at the same time reducing feeding competition between the various species are set in motion. (Baker-FRC)
W82-02434

LIMNOLOGICAL AND GEOCHEMICAL SURVEY OF WILLIAMS LAKE, HUBBARD COUNTY, MINNESOTA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. LaBaugh, G. E. Groschen, and T. C. Winter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-123068, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-41, 1981. 38 p, 14 Fig, 8 Tab, 39 Ref.

Descriptors: *Lakes, *Limnology, *Geochemistry, *Mineralogy, Sediments, Groundwater, Nutrients, Phytoplankton, Zooplankton, Aquatic plants, *Minnesota, Hubbard County, *Williams Lake.

A limnological and geochemical survey of Williams Lake, Minn., was made in 1979 to provide an initial interpretative description of the lake and the contiguous ground-water system. This survey was made as part of a continuing research program related to the investigation of the interaction of lakes and their contiguous groundwater systems at Williams Lake, Minn., as well as other sites within the continental United States. During 1979, Williams Lake was dimictic, and the lake had high optical transparency; light penetrated to the lakebed throughout most of the lake. Aquatic macrophytes were present along the western shore and in the southern bay of the lake. Although the lake had clinograde-oxygen distributions during part of this survey, anaerobic conditions were not observed. The lake is moderately fertile with respect to its total phosphorus content. Nutrient data indicate phosphorus limits phytoplankton biomass levels in Williams Lake. Blue-green algae were the dominant group of the phytoplankton community and copepods were the dominant group of the zooplankton community when the lake was thermally stratified during the open-water season. Calcium and bicarbonate represent more than 90 percent of the dissolved constituents in Williams Lake and the contiguous ground-water system. Major mineralogical constituents of the lake sediments are quartz, dolomite, and calcite. Marl is present only in the littoral zone of the lake. Organic sediments in the lake consist of loose organic floc and gyttja. (USGS)
W82-02471

SUMMER REAERATION AND WINTER ICE REMOVAL FROM LAKES AND RESERVOIRS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157793, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Technical Completion Report, November, 1981. 63 p, 28 Fig, 12 Tab, 12 Ref. OWRT-B-043-OKLA(2), 14-34-001-9091.

Descriptors: *Lakes, Destratification, *Ice removal, Garton pump, Water quality, Fish kills, *Reaeration, Aeration, *Phosphorus removal, *Lake Texoma, Texas, Oklahoma.

This report has three parts. Part one concerns an experiment conducted on Lake Texoma with an eight-foot propeller. Outflows ranged from 50 to 600 cubic feet per second. Maximum improvement for the various parameters occurred at different release rates. Maximum improvements observed were a 83-percent reduction in turbidity, a 68-percent reduction in sulfides, a 49-percent reduction in manganese, and a 53-percent reduction in phosphorus. Part two concerns experiments conducted at Pine Creek Reservoir near Valliant, Oklahoma. These experiments were with outflows ranging from 30 to 90. Experiments were conducted with various sizes of propellers pumping surface water downward to the vicinity of the outlet. Reductions of the levels of iron and manganese in the outlet releases of 60 to 70 percent have been achieved with less than 2 horsepower input. Part three concerned winter ice removal on a 100-acre lake with a six-foot propeller pumping water upward. During a severe winter for Oklahoma when ice thickness was approximately nine inches, an open area of approximately one acre was maintained. This should be of benefit to waterfowl and should prevent winter fish kills under snow covered lakes.
W82-02526

THE USE OF GROUND-WATER FLOW MODELS FOR ESTIMATING LAKE SEEPAGE RATES,
Geological Survey, Iowa city, IA.
For primary bibliographic entry see Field 2F.
W82-02549

NITROUS OXIDE CONCENTRATIONS IN LAKES: VARIATIONS WITH DEPTH AND TIME,
McGill Univ., Montreal (Quebec). Dept. of Microbiology.
R. Knowles, D. R. S. Lean, and Y. K. Chan.
Limnology and Oceanography, Vol 26, No 5, p 855-866, September, 1981. 8 Fig, 27 Ref.

Descriptors: *Nitrous oxide, *Lakes, *Sinks, Water depth, Air pollution, Denitrification, Nitrification, Trophic level, Path of pollutants.

Depth profiles of N20 were compared to other variables for several Ontario lakes which differ in size, depth, and trophic state. Water samples were collected, and the following were determined: chlorophyll alpha, dissolved total Kjeldahl nitrogen, NH4(+), NO2(-), NO3(-), and dissolved N20. Profiles of concentrations of 02 and nitrogen compounds in the different lakes indicated that the lakes can act as either net sources or sinks for atmospheric N20. High concentrations of N20 in Thompson Lake, a eutrophic lake, were found in the metalimnion during spring stratification when hypolimnetic 02 and NO3(-) were already being depleted. Up to 4 micrograms of N20 per liter were determined in oxygenated NO3(-)-containing bottom waters where both nitrification and denitrification were probably occurring. A third type of N20 distribution occurred in mesotrophic Lake St. George where an N20 maximum occurred in the metalimnion, with relatively low concentrations above and below this depth. (Small-FRC)
W82-02553

ON THE OCCURRENCE OF BIMODAL DIEL DISSOLVED OXYGEN CURVES IN AQUATIC SYSTEMS,
Amsterdam Univ. (Netherlands). Lab. of Aquatic Ecology.
R. Lingeman, and P. Ruardij.
Hydrobiologia, Vol 78, No 3, p 267-272, 1981. 2 Fig, 13 Ref.

Descriptors: *Dissolved oxygen, *Irradiation, *Water temperature, *Aquatic habitats, Ponds, Productivity, Primary productivity, Oxygen, Temperature.

A two-year study of biomodal diel dissolved oxygen curves in an artificial pond suggested that a persistent high irradiation level and/or a high rate of temperature increase and/or a simultaneous high rate of primary production may induce this phenomenon. About 28% of the diel oxygen curves were bimodal, usually with a first maximum in the afternoon and a second in the evening (separated by 1 to 4 hours). About 60% of the bimodal curves appeared in May and June, but never in October through March. Bimodal curves were observed at different levels of under- and super-saturation (between 65 and 150%). Both types of curves started and ended at the same level. The first maximum of the bimodal curve was the same height as the maximum of the unimodal one. There were no significant differences between unimodal and bimodal curves in the following: temperature at the moment of oxygen maximum, daily mean temperature, moment of minimum temperature and its value, moment of maximum temperature and its value, diurnal net production and respiration, daily range of concentration values, moment of the first oxygen minimum, and oxygen concentration at the minimum. (Cassar-FRC)
W82-02565

INTERACTIONS POTENTIALLY AFFECTING THE SEASONAL ABUNDANCE OF SELECTED AQUATIC INVERTEBRATES IN A RICE FIELD HABITAT,
Minnesota Univ., St. Paul.
For primary bibliographic entry see Field 6G.
W82-02568

MAJOR PHYSICAL FEATURES OF LONG POINT BAY AND ITS WATERSHED,
Ontario Ministry of the Environment, Toronto. Water Resources Branch.
I. W. Heathcote.
Journal of Great Lakes Research, Vol 7, No 2, p 89-95, 1981. 3 Fig, 13 Ref.

Descriptors: *Watersheds, *Physical properties, *Long Point Bay, Geologic history, Lakes, Lake Ontario, Sedimentation, Shores, Climates, Land use, Water resources development, *Ontario, *Lake morphology.

A summary of background information on the Long Point Bay area in Ontario, Canada is presented. The Bay itself is situated on a band of bedrock and surficial deposits which has similar characteristics from Buffalo to Port Stanley. The area is characterized by Devonian bedrock with overlying tilles, lacustrine sands or clays. There are some dynamic areas of soil erosion where the overburden is thick, with steep bluffs of 30 or more meters height dropping to lake level. Sediment transport is extensive here, with eastward accretion occurring at the top of Long Point. Several small streams drain the narrow Long Point Bay watershed. Most flow directly to the lake. Some of the smaller ones are periodically dry, thus posing problems for water supply and sewage effluent discharge throughout the area. Main lake currents influence the circulation in the bay as well as shoreline and bottom configuration. Extensive agricultural loadings do occur in the bay, but the water quality is the best in the nearshore Lake Erie area. Chemical parameters are fairly evenly dispersed over the bay area. Physical parameters such as turbidity do register local variations. The combination of relatively clean water, long sandy beaches, and extensive marshland makes the Long Point area attractive for recreational purposes also. These purposes serve to enhance the local economy. Long term environmental monitoring programs are underway, conducted by the local industries and the Ontario Ministries of the Environmental and Natural Resources. (Baker-FRC)
W82-02579

LARM TWO-DIMENSIONAL MODEL: AN EVALUATION,
Tennessee Technological Univ., Cookeville.
For primary bibliographic entry see Field 4A.
W82-02597

2I. Water In Plants

DIURNAL VARIATION IN WATER POTENTIAL COMPONENTS AND STOMATAL RESISTANCE OF IRRIGATED PEACH SEEDLINGS,
New Jersey Agricultural Experimental Station, New Brunswick.
E. Young, J. M. Hand, and S. C. Wiest.
Journal of the American Society for Horticultural Science, Vol 106, No 3, p 337-340, May, 1981. 4 Fig, 12 Ref.

Descriptors: *Diurnal distribution, *Water potentials, *Irrigation, Plant water potential, *Peach, Stomatal transpiration.

The objectives of this study were to explore the diurnal changes in total water potential and the osmotic and turgor potential components, and to determine the relationship of turgor potential with stomatal resistance in irrigated peach seedlings. Open-pollinated 'Halford' peach seeds were sown in a greenhouse bed in August, 1970, and allowed to grow for 3 months, until they were about 1 meter tall. A significant positive correlation was noted between turgor potential and total water potential, while osmotic potential remained fairly constant. There also appeared to be no rapid diurnal osmotic adjustment to maintain constant turgor, although there may have been some slight, long-term osmotic adjustment over the two week experimental period. When turgor approached zero, a depression of osmotic potential due to water loss through transpiration maintained turgor above zero. Stomatal resistance remained low throughout the day, even though total water potential dropped below -16 bars and turgor potential was below 2 bars. Stomatal resistance was negatively correlated with irradiance level but not with turgor potential. (Baker-FRC)
W82-02202

THE EVALUATION OF A LEAF-WATER POTENTIAL FUNCTION FOR CORN,
Kansas Agricultural Experiment Station, Colby.
F. R. Lamm, J. M. Gregory, and H. S. Cengiz.
Transactions of the ASAE, Vol 24, No 5, p 1172-1176, September-October, 1981. 3 Fig, 2 Tab, 40 Ref.

Descriptors: *Leaves, *Water potentials, Mathematical studies, Water availability, Irrigation, Soil water potential, Soil water, *Corn, Farming, Model studies.

An attempt was made to develop a simple model for leaf-water potential that could be used in scheduling irrigation. An equation relating leaf-water potential to vapor pressure deficit and soil water potential was developed for corn in Missouri. The soil water potential at the 30 cm depth was used to keep calculations relatively simple. The equation gave reasonable predictions over the range of observed data. The theoretical basis of the equation also satisfied many of the boundary conditions. The soil water potential at the 30 cm depth never fell below minus 5 bars in the two years of study on this northeast Missouri claypan soil. This limited range of soil moisture probably represented only a minor concern, as a soil water potential of minus 5 bars would probably not be permitted under irrigation. Many of the constants and functional relationships were evaluated by regression techniques. Some or all of the constants may be specific to one soil type and/or location. Although the constants may vary, the procedure used in the development should be applicable to other climates and soil types. (Baker-FRC)
W82-02226

WHEAT RESPONSE TO DROUGHT,
Science and Education Administration, Florence, SC.
R. E. Sojka, and L. H. Stolzy.
California Agriculture, Vol 35, No 9/10, p 14-15, September/October, 1981. 4 Fig.

Descriptors: *Wheat, *Drought, Moisture stress, Available water, Water stress, *Soil water, Plant water potentials, *Crop yield, Experimental farms, *Sonoran Desert, *Mexico.

Field experiments on wheat stress physiology and yield interrelationships were conducted for two years by scientists in Mexico, on the Sonoran Desert. Numerous soil and plant water status measurements were made to characterize the severity of the treatments imposed. Of special importance were measurements of xylem pressure potentials for plant water status, soil water content, and yield. Cultivars in any given stress treatment did not differ markedly in water use, but well-irrigated controls required about 3.5 times as much water as did plants in any of the stressed treatments. Soil water regimes were nearly identical for all the cultivars in any given stress treatment. The daily stress patterns could be expressed statistically as three linear phases of the xylem pressure potential response. In the morning this response began to drop until about 10 AM. After 11 AM the response ceased to drop, stabilizing until about 4 PM, after which stress relief was evident and the resonse began to rise. As the season progressed, the daily responses during the stable midday periods resulted in several relationships. Daily responses reflected the increased severity of stress in the nonirrigated treatments. Eventually a point was reached when the xylem pressure potential did not return to near zero values before dawn. Instead, plants were forced to enter succeeding daily cycles without full recovery. When presunrise recovery values fell to minus 7 bars, the yield loss was about 80% compared to controls. Plant water status measurements have a genuinely important role in evaluating wheat cultivars for response to drought. (Baker-FRC)
W82-02242

EFFECT OF CORN AND SOYBEAN ROW SPACING ON PLANT CANOPY, EROSION, AND RUNOFF,
Science and Education Administration, Ames, IA.
T. S. Colvin, and J. M. Laflen.
Transactions of the ASAE, Vol 24, No 5, p 1227-1229, September/October, 1981. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Agricultural engineering, *Runoff, Erosion, Plant growth, Corn, Soybeans, *Erosion control.

The effects of row spacing on the development of plant canopy cover were determined, and the effects of row spacing on erosion hazard were considered. Two Iowa experimental sites of nearly uniform slope, previously in row crops, were chosen to contrast soils and slopes. A randomized complete-block design with two replications was used at each location. There were six treatments: fallow; soybean row widths of 250, 510, and 760 mm; and corn row widths of 510 and 760 mm. The corn row widths showed less effect on canopy development than the row width of soybeans. The 510 and 760 mm wide corn rows did not show much difference in canopy development at either location up to 50% cover, but the 510 mm wide corn rows reached 75% cover about 10 days earlier than the 760 mm wide corn rows at Castana. Row width had no significant effect on runoff volume. As the season progressed, runoff volumes from the fallow plots were significantly greater than those from the cropped areas at Castana. There was little if any observable effect of kind of crop or row width on soil erosion at any crop stage. This was apparently caused by two factors. First, very little difference was expected between the treatments, based on soil loss predictions using the Universal Soil Loss Equation, and second, the precision in this study and likely in most studies dealing with soil, plants, and topography was not sufficient to detect the small difference expected. Narrow row cropping should have only a minor effect on field soil losses, if surface conditions are no different for narrow row crops than for wide row crops. The effect of the narrower rows, if observable, should be to reduce field soil losses. (Baker-FRC)
W82-02264

EVAPOTRANSPIRATION AND LEAF WATER STATUS OF ALFALFA GROWING UNDER ADVECTIVE CONDITIONS,
British Columbia Ministry of Environment, Kamloops.
For primary bibliographic entry see Field 2D.
W82-02295

ESTIMATING CONTRIBUTION OF OVERSTORY VEGETATION TO STREAM SURFACE SHADE,
Pacific Northwest Forest and Range Experiment Station, La Grand, OR.
T. M. Quigley.
Wildlife Society Bulletin, Vol 9, No 1, p 22-27, 1981. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Vegetation effects, *Natural streams, *Solar radiation, Water quality, Temperature effects, Environmental effects, Shaded streams.

A method was developed for estimating the contribution of forest overstory to stream surface shade to aid in the prediction of solar heating of streams. Average stream width, average vegetation to stream distance, and stream orientation are inputs. Vegetation contributes to stream shade through overstory height, vegetation density, and crown size. The information needed to calculate stream shade can be gathered when stream inventory data are collected. The method was illustrated using an example. The method can aid managers in estimating stream surface shade and thus help in managing stream water quality, particularly water temperature. (Small-FRC)
W82-02301

SEASONAL PATTERNS OF PLANT AND SOIL WATER POTENTIAL ON AN IRREGULARLY-FLOODED TIDAL MARSH,
Smithsonian Institution, Rockville, MD. Radiation Biology Lab.
T. M. De Jong, and B. G. Drake.
Aquatic Botany, Vol 11, No 1, p 1-9, July, 1981. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Water potentials, *Aquatic plants, *Tidal marshes, Soil-water-plant relationships, Soil water potential, Plant water potential, Species composition, Salinity, Rhode River, *Chesapeake Bay, Marshes.

Plant water potential and soil water potential were measured in four salt marsh plant communities to determine whether there were correlations between the water potentials of the species and the soils in which they grew. Measurements were taken before dawn once a week throughout the 1978 growing season in a tidal marsh near Rhode River, Chesapeake Bay. Two species, Scirpus olneyi Gray and Scirpus robustus Pursh, had water potentials $>$ or $=$ -5 bar throughout the season and showed no seasonal trends. Mean seasonal dawn water potentials were -3.3 and -2.6 bar, respectively. Three species, Iva frutescens L., Spartina cynosuroides L. Roth, and Panicum virgatum L., had water potentials that ranged between nearly zero to -16 bar, with values generally decreasing as the season progressed. Mean seasonal dawn water potential values were -5.3, -6.0, and -7.5 bar, respectively. Soil water potentials at 50 cm depth did not vary more than 3 bar for any given community. Mixed communities always had the most negative mean soil water potential; creek bank communities, intermediate; and forest margin, the least negative. Measurements at 10 cm, the root zone, became more negative as the season progressed and reversed slightly at the very end of the sampling period. Contrary to expectations, plant species with the lowest dawn plant water potentials occurred in communities having the highest soil water potentials and vice versa. Therefore, no clear correlation between plant and soil water potentials could be made. Salinity and root systems are possible factors in plant species distribution. (Cassar-FRC)
W82-02340

LEAF PHOTOSYNTHESIS, LEAF PERMEABILITY, CROP GROWTH, AND YIELD OF

SHORT SPRING WHEAT GENOTYPES UNDER IRRIGATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
R. A. Fischer, F. Bidinger, J. R. Syme, and P. C. Wall.
Crop Science, Vol 21, No 3, p 367-373, May/June, 1981. 2 Fig, 5 Tab, 23 Ref.

Descriptors: *Irrigation, *Wheat, *Crop yield, Photosynthesis.

Forty-eight genotypes of spring wheat were flood irrigated at seeding and 6 times during the growing season to determine the relationships of leaf photosynthesis to crop growth rate and yield. Wheats investigated were 3 tall and 33 short (Norin 10-derived) bread wheats (Triticum aestivum L.), 8 short durum wheats (T. Turgidum L.,) and 4 triticales (X Tritosecale Wittmack). Species effects were not significant. However, genotypic effects on photosynthetic activity ranged from 14.7 to 20.4 mg CO2 per sq dm per hr and leaf permeability to viscous airflow, from 5.6 to 11.1 permeability units. In the short bread wheat group photosynthesis was not related to specific leaf weight or to leaf permeability. AT 4 weeks before anthesis, photosynthesis and preanthesis crop growth rate were weakly correlated, and both these traits were positively correlated with mature plant height. Photosynthesis was also positively correlated with crop growth rate during grain filling and with yield. Yield was positively correlated with leaf permeability. Effects of dwarfing genes on these relationships are discussed. Highest crop yields (767 g per sq meter) were in a Rht 2 gene group, genotypes Cajeme 71, Ferc 4A, Ferc 3, Yaqui 50E, Vicam 71, Kal-Bp, S948-A1. (Cassar-FRC)
W82-02373

IRRIGATION REQUIREMENTS OF FIELD-PEA FOR GRAIN,
Indian Council of Agricultural Research, New Delhi.
S. B. Hukkeri, and A. K. Sharma.
Indian Journal of Agricultural Sciences, Vol 50, No 2, p 157-160, February, 1980. 1 Tab, 4 Ref.

Descriptors: *Moisture availability, *Crop yield, Drought, Water stress, Frost, Farming, Frost protection, Soil moisture, Water table, *Irrigation requirements, Loam, *Soil-water-plant relationships, Field pea.

The distribution of rainfall and the availability of soil water before irrigations were evaluated. Field experiments were conducted in the winter of 1972-73 and 1973-74 on a sandy-loam soil of medium fertility. The field was high-lying, with the water table located more than 3 to 4 meters below the surface. The available water content in 0-60 cm depths of soil layer was 106 mm. In 1972-73 a total of 114 mm rainfall was received in three periods. In 1973-74 rainfall was negligible, only 6.3 mm of rain being received. Irrigation treatments varied according to the physiological stages of the crop. In 1972-73 the crop did not respond to the differential irrigation treatments due to the fact that rainfall was received three times during the growth period. The rains coincided with the initiation of flowering and pod formation, thus fulfilling the water needs of the crop. In 1973-74 the crop responded to differential irrigations. One irrigation given either at the vegetative stage or at the initiation of the flowering stage produced significantly higher yield as compared with the treatment with no irrigation after sowing. Two irrigations applied at the initiation of flowering and the pod development stages or at the initiation of flowering and pod formation further increased the yield. Irrigation at the vegetative stage caused the crop to yellow and reduced yields. This low yield may be due to an impeded oxygen supply to the crop due to the sealing effect or surface irrigation. The maintenance of high available moisture in the active root zone during flower initiation to early podding also helped plants tolerate frost. (Baker-FRC)
W82-02395

SOIL MOISTURE USE BY MIXED CONIFER FOREST IN A SUMMER-DRY CLIMATE,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
R. J. Arkley.
Soil Science Society of America Journal, Vol 45, No 2, p 423-427, March/April, 1981. 4 Fig, 7 Tab, 5 Ref.

Descriptors: *Forest soils, *Moisture availability, California, Water use, Soil water, Streamflow, Hydrologic budget, Trees, Forests, Pine trees, Seasonal variations, *Soil-water-plant relationships, *San Bernardino Mountains.

Soil moisture regimes were studied at 16 sites in the San Bernardino Mountains, an east-west ranged dominated by granitic rock types. All sites were within a mixed conifer forest dominated by ponderosa pine with associated sugar pine, incense-cedar, and California black oak and by Jeffrey pine with white fir. Soil moisture depletion occurred to depths of 274 cm from coarse loamy and sandy-skeletal soils and underlying decomposed granite. Available soil moisture storage ranged from 129 mm, where hard rock was encountered at 121 cm, to as high as 496 mm, where the underlying material was grus. Water use during the growing season appeared equal to available moisture storage during long dry summers, but was considerably increased in years with summer precipitation. Water use by the trees extends to depths considerably deeper than the 274 cm sampled. Productivity, and in fact survival, of the forest trees in this summer-dry climate appear to depend on moisture stored at considerable depth in fractured or decomposed rock. Tree use of such deep moisture may explain the relatively small runoff measured in southern California streams compared with that estimated by the water balance method. (Baker-FRC)
W82-02558

NUTRIENT CONTENTS OF PRECIPITATION AND CANOPY THROUGHFALL UNDER CORN, SOYBEANS, AND OATS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
E. M. White.
Water Resources Bulletin, Vol 17, No 4, p 708-712, August, 1981. 4 Tab, 17 Ref.

Descriptors: *Nutrients, *Rainfall, *Soil-water-plant relationships, Crops, Ammonia, Nitrogen, Phosphorus, Nitrates, Runoff, Storm events, Soil water, Rainfall-runoff relationships, Corn, Soybeans, Oats, Throughfall, Canopy, Cycling nutrients, Water pollution sources.

Nutrients in meteoric precipitation (MP) and throughfall precipitation (TFP) were studied to determine their potential effects on runoff quality. Corn, soybean, and oat canopy TFP and MP were collected, respectively, at 10 cm and 1.5 meters above ground level. MP, TFP, and runoff samples were collected as soon as possible after an event, usually within 18 hrs. Differences in the bulk ammonia-nitrogen concentration in MP and TFP were slight for corn and oats, but soybean canopies enriched the MP with ammonia-nitrogen. Canopies of the three crops enriched MP with nitrate-nitrogen, particularly near the row for corn. Plant canopies increased the soluble and total phosphate-phosphorus concentrations, particularly near the corn rows. Soybeans had a similar effect on soluble phosphate-phosphorus but not on total phosphate-phosphorus. When the concentrations of nutrients found in MP, TFP, and in runoff from soil were calculated, the average ammonia-nitrogen concentrations decreased from MP to TFP to runoff. It was concluded that PM falling on soybeans loses ammonia-nitrogen and soluble phosphate-phosphorus to the vegetation, but gains nitrate-nitrogen, total phosphate-phosphorus and soluble potassium. With corn, ammonia-nitrogen is lost if the MP content is high otherwise MP gains ammonia-nitrogen, nitrate-nitrogen, soluble phosphate-phosphorus, total phosphate-phosphorus and soluble potassium from the canopy. Oat canopies enrich MP with the five ions. TFP concentrations were not large enough to determine the nutrient content of soil runoff water. (Baker-FRC)
W82-02574

2J. Erosion and Sedimentation

FLOW REGIME AND SEDIMENT LOAD AFFECTED BY ALTERATIONS OF THE MISSISSIPPI RIVER,
For primary bibliographic entry see Field 4C.
W82-02125

ATCHAFALAYA DELTA: SUBAERIAL DEVELOPMENT; ENVIRONMENTAL IMPLICATIONS AND RESOURCE POTENTIAL,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 349-364, 11 Fig, 1 Tab, 11 Ref.

Descriptors: *Estuaries, *Deltas, *Wetlands, *Floods, Sediment transport, Hydrodynamics, Marshes, Mudflats, Habitats, Mississippi delta, Louisiana.

A major geologic event in the history of the Mississippi delta system is now in progress along the central Louisiana coast. Because of a distinct gradient advantage, the main distributary of the Mississippi River, the Atchafalaya River, is rapidly developing a subaerial delta in Atchafalaya Bay, 130 miles (200 km.) west of the modern bird-foot delta. The subaerial growth of the new delta is being monitored with remote sensing techniques, land and hydrographic surveys and a sediment sampling program. Initial formation of new land in the Atchafalaya Delta has been found to occur sporadically with accretional periods coinciding with flood pulses of the river. Approximately 12.39 sq mi (32 sq km) of new land had been formed by 1976 with additional accumulations following the 1979 flood. A prototype data collection program is currently underway to provide data for a study of estuarine hydrodynamics and sediment transport in the bays and near offshore areas of the Atchafalaya-Vermillion estuarine complex. Accretional impact lines include subaerial deltaic sedimentation, subaqueous bay fill and mudflat-marsh building in a region formerly characterized by shoreline retreat. These impacts are presently producing negative effects on open water habitats, but the potential for improved marsh and aquatic nursery ground environments and expansion of human habitats in the vicinity of Morgan City far outweighs loss of open bay habitats. The Corps of Engineers is considering several project alternatives for mitigation of present impacts and management of future delta growth. (Author's abstract)
W82-02126

SEDIMENT--ASSET OR LIABILITY,
Coastal Environments, Inc., Baton Rouge, LA.
For primary bibliographic entry see Field 6B.
W82-02150

THE RIVER CONTINUUM: A THEORETICAL CONSTRUCT FOR ANALYSIS OF RIVER ECOSYSTEMS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
For primary bibliographic entry see Field 6G.
W82-02157

THE DOWNSTREAM TRANSPORT OF FINE MATERIAL AND THE ORGANIC MATTER BALANCE FOR A SECTION OF A SMALL CHALK STREAM IN SOUTHERN ENGLAND,
Freshwater Biological Association, East Stoke (England). River Lab.
For primary bibliographic entry see Field 1B.
W82-02192

SEDIMENT TRANSPORT DURING A CONTROLLED RESERVOIR RELEASE,

Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta, W. L. Jackson, and K. D. Knoop.
Water Resources Bulletin, Vol 17, No 4, p 635-641, August, 1981. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Sediment transport, *Reservoir releases, Tractive forces, Sediment distribution, Utah, Flow control, Reservoir fisheries, Streams.

A controlled release of water from Electric Lake Reservoir, in central Utah, was undertaken for the purpose of improving the downstream fisheries habitat by removing fine sediments from the Huntington Creek stream channel. The Electric Lake Dam was constructed from 172 to 174. During this same time period State Highway 31 was upgraded. Both activities increased sediment delivery along much of Huntington Creek. The controlled release was planned for early August 1979, with a peak discharge of 5.7 cubic meters/second or more. The release was to last for 75 hr, beginning with a series of incremental increases over a six-hour period, culminating in a peak discharge to be held for 18 hr, but then rapidly dropped and finally returned to a flow slightly less than the original peak for the remainder of the release. In practice, however, the peak flow was 4.9 cubic meters/second. No changes in the armour layer occurred, and thus no changes in cross sectional profiles at the riffles were noted and no differences were found in the frozen streambed cores obtained before and after the release. A considerable amount of sediment was apparently available from other in channel locations, including fine sediments scoured from pools and along channel banks as well as deposits on stable riffles and from beaver ponds. It is not known as yet whether this flushing of fine sediments from channels and riffles actually improved the aquatic habitat for the fish. (Baker-FRC)
W82-02196

FORMATION OF A BOTTOM FLOW IN A NATURAL WATER BODY WITH VARIOUS TYPES OF DENSITY STRATIFICATION,
Moscow State Univ. (USSR).
Yu. G. Pyrkin, B. I. Samolubov, and E. I. Debol'skaya.
Water Resources (English Translation), Vol 7, No 4, p 365-374, July-August, 1980. 6 Fig, 1 Tab, 14 Ref. Translated from Vodnye Resursy, No 4, p 144-155, July-August, 1980.

Descriptors: *Bottom currents, *Density currents, *Stratification, Flow characteristics, Suspended sediments, Sediments, *Sediment transport.

Knowledge of density current structures and formation is needed to improve methods of predicting siltation of water bodies, controlling alluviation, and discharging high-density wastewaters. Density currents were investigated in a canyon-like water body about 50 km long, up to 5 km wide, and up to 300 meters deep. It receives a powerful river sediment load composed of very fine (less than 50 micrometers) suspended particles. Average sediment concentration is 4 kg per cu meter; river water temperature is 1-6 C less than in the basin; and a plume up to 30 km forms. The following were recorded: the vertical distribution of the concentration of the suspended material, water temperature, current velocity on sections along the axis of the flow, and the temporal variation of these flow parameters at the initial points on the longitudinal-axial sections of the current. A decrease in the velocity of the streamflow upon increase of the cross-sectional area at the river mouth led to deposition of the suspended particles and formation of a high-density bottom fluid layer with a well-defined upper boundary. Separation of the bottom stratified flow into two vertical zones with a maximum density gradient and minimum flow velocity in the region of their boundary occurs. This process is accompanied by decreases in the concentration of suspended material in the flow and in its thickness. Thus, separation of suspended particles by size occurs during formation of the stratified bottom flow. the two-layer structure is a metastable, transient state of the density current during its formation; nevertheless, the stability of the upper boundary of the forming stratified flow is no less than in the case of a turbidity (mechanically stratified) current. (Cassar-FRC)
W82-02205

DERIVING SEDIMENT YIELD PROBABILITIES FOR EVALUATING CONSERVATION PRACTICES,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
W. C. Mills.
Transactions of the ASAE, Vol 24, No 5, p 1199-1203, 1210, September-October, 1981. 2 Fig, 28 Ref.

Descriptors: *Agricultural engineering, *Soil management, *Soil erosion, Erosion, Sedimentation, Farming, Soil engineering, Soil conservation, Conservation, Model studies, Mathematical models, Rainfall, runoff, *Sediment yield, Sediment distribution, *Probability distribution.

Probability distributions of annual sediment yield are derived for both conventional and minimum tillage of watershed cropland. These sediment yield distributions are needed to adequately evaluate future effects of alternative conservation practices. They can be derived by coupling stochastic models of rainfall and watershed state to a deterministic model of the sediment yield process. Such coupling transforms rainfall and state probabilities to sediment yield probability distributions. Several deterministic event based models that predict watershed sediment output for given rainfall event characteristics and watershed state have been proposed and are briefly noted. One of these, which is readily available, was used to demonstrate sediment yield probability computations. A bivariate rainfall model, consisting of a Weibull distribution for rainfall event duration and a log-normal distribution for event depth with given duration, was demonstrated. A watershed state model giving probabilities for three classes of antecedent moisture conditions was used. A coupling technique derived from probability generating function was used to provide accurate transformation of rainfall and state probabilities. Probability distribution of annual sediment yield from Ahoskie Creek watershed near Ahoskie, North Carolina were computed for conventional and minimum tillage. The sediment yield probability distribution computed for conventional tillage was checked by comparing computed values with the average and range of reservoir sediment measurements. (Baker-FRC)
W82-02225

RUNOFF CURVE NUMBERS FOR NORTHERN PLAINS RANGELANDS,
Science and Education Administration, Boise, ID.
For primary bibliographic entry see Field 2A.
W82-02245

VERIFICATION OF THE SLOPE FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION FOR LOW SLOPES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. E. Murphree, and C. K. Mutchler.
Journal of Soil and Water Conservation, Vol 36, No 5, p 300-302, September-October, 1981. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Erosion, *Slopes, Slope stability, Farming, Erosion rates, Erosion control, Simulation, Model studies, Rainfall, *Soil erosion, Mississippi Delta.

A site in the Mississippi Delta near Jonestown, Mississippi, was selected for a study of soil loss under rainfall conditions. On the chosen plots the soil was deep enough so that cutting and filling could be done to establish the desired slopes on adjacent rainulator plots. Six plots were duplicated, with slopes of 0.1, 0.2, 0.5, 1, 2, and 3%. Soil samples were taken before each run to determine the antecedent soil water content. Sediment samples were taken during the runs at 3 minute intervals. Continuous records of runoff were computed. The slope-factor equation of the universal soil loss equation (USLE) was based primarily on data from slopes greater than 3%. Thus it is reasonable to suspect some discrepancy in soil loss estimates for flatter slopes. Soil losses from 75 foot plots were less than half that predicted by the USLE for slopes less than 0.2%. This discrepancy approached zero for slopes of about 3%. It is also noted that the greater surface water depths found on flat lands under high rainfall intensities reflected in the R-factor would reasonably be expected to reduce erosion more extensively on flatlands than on steeper land. This expectation was supported by the data of this study. However, the irregularity of farm-field surfaces exposed only a portion of the surfaces to raindrop impact. This portion was estimated to be about one-half. It was recommended that the use of the present slope factor equation used in the USLE be continued, but the soil loss estimates for flatlands be reduced by an R-factor coefficient. (Baker-FRC)
W82-02246

MAJOR- AND TRACE-ELEMENT COMPOSITION OF SUSPENDED MATTER IN THE NORTH-EAST GULF OF ALASKA: RELATIONSHIPS WITH MAJOR SOURCES,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5B.
W82-02259

ESTIMATING SEDIMENT TRANSPORT CAPACITY IN WATERSHED MODELING,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. V. Alonso, W. H. Neibling, and G. R. Foster.
Transactions of the ASAE, Vol 24, No 5, p 1211-1220, 1226, September/October, 1981. 1 Fig, 4 Tab, 33 Ref.

Descriptors: *Sediment transport, *Model studies, Tractive forces, Mathematical studies, Watersheds, *Sediment-carrying capacity, Estimating.

Attempts were made to evaluate, using available data, a number of the sediment transport formulas suitable for watershed modeling. The first part of the paper describes the criteria followed in selecting the formulas. The second part lists the characteristics of these data, which included 739 tests from natural streams, laboratory flumes, and erosion plots. The third part examines how well each formula fits the data when it is used directly, without modification or readjustment of its coefficients. Recommendations are made regarding the applicability of the formulas within different ranges of the data. Of the nine sediment transport formulas compared with flume field data, the Yang formula best estimated streamflow carrying capacity in the range of fine to coarse sands. The Laursen formula reasonably predicted small streamflows carrying very fine sands and silts. However, it should be used with some reservations for computing transport of lighter materials. The Yalin formula can be used to compute sediment transport capacities for overland flows. It gave satisfactory results for the range of sizes and densities characteristic of field situations, and can also be used with confidence to predict transport rates of light materials in streamflows. The other formulas considered included: Ackers-White, EM-1, EM-2, Engelund-Hansen, Laursen, Bagnold, and Meyer-Peter Muller. (Baker-FRC)
W82-02265

NUTRIENT AND SEDIMENT LOADINGS FROM A SUBSURFACE DRAINAGE SYSTEM,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W82-02266

SEDIMENT YIELD FROM A MISSISSIPPI DELTA COTTON FIELD,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
F. E. Dendy.
Journal of Environmental Quality, Vol 10, No 4, p 482-486, October/December, 1981. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Sediment yield, *Erosion rates, *Soil erosion, Cotton, Mississippi, Sediment distribution, Sediment sorting, Particle size, Sediment concentration, *Agricultural runoff, Runoff, Vegetation effects.

Sediment yields from flat (0.2%) delta fields in Mississippi were higher than expected, from a low of 5.1 metric tons per ha per year in 1978, a year of below normal rainfall, to 12.0 metric tons per ha per year in 1979, a year of above-normal rainfall. Mean monthly concentrations of sediment in runoff varied from 164 ppm in October to 2750 ppm in April. This shows the effects of the vegetation-bare fields during seedbed preparation in April-May and after harvest and fall plowing in November. Using these cultural practices, fields are highly susceptible to erosion in January, April, May, and November. During August-October vegetation protects the soil from severe erosion. Particle size distributions of sediments washed from the fields were > 62 microns, (sand) none; and < 2 microns (clay), 83%. 98% of the material was < 16 microns in diameter. The proportion of fine material (clay) was the same for large and small storms (0.5-3.6 cm per hour). Field soils were composed of 24% particles < 2 microns, 47% < 53 microns, and 53% > 53 microns. The particles removed by erosion were largely finer materials, producing a gradual enrichment of coarse particles in the soil over long periods of time. (Cassar-FRC)
W82-02324

BANK FAILURE AND EROSION ON THE OHIO RIVER,
Louisville Univ., Kentucky. Dept. of Civil Engineering.
D. J. Hagerty, M. F. Spoor, and C. R. Ullrich.
Engineering Geology, Vol 17, No 3, p 141-158, 1981. 9 Fig, 3 Tab, 6 Ref.

Descriptors: *Bank erosion, *Rivers, *Flood damage, Erosion, *Ohio River, Currents, Navigation, Wave action, Internal water, Alluvial soils.

The construction and operation of navigation dams and towboat traffic on the Ohio River have been blamed for bank erosion and failures. However, examination of historical information and monitoring and mapping investigations have shown that bank failure is not caused by these processes but is a function of bank materials, topography, land use, river morphology, and weather cycles. Review of historical illustrations, photographs, and literature dating back to 1770 reveals that severe bank erosion has been common during this entire period. Although bank failure and erosion are episodic and complex, the most important mechanism appears to be removal of bank material by current forces during floods and internal erosion of bank materials by bank discharge after floods. Age of navigation pools, water level fluctuations within a pool, waves generated by vessels, and boat traffic volume showed no correlation with bank failure. The coarse alluvial soils, common along the Ohio, are especially subject to erosion. (Cassar-FRC)
W82-02343

FLASH FLOOD IN ARIZONA - OBSERVATIONS AND THEIR APPLICATION TO THE IDENTIFICATION OF FLASH-FLOOD DEPOSITS IN THE GEOLOGIC RECORD,
Geological Survey, Flagstaff, AZ.
For primary bibliographic entry see Field 2A.
W82-02350

TWO BED-LOAD FORMULAS: AN EVALUATION,
Ain Shams Univ., Cairo (Egypt).
M. I. Amin, and P. J. Murphy.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY8, p 961-972, August, 1981. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *Sediment transport, *Bed load, *Sand, Channel scour, Bed load discharge, Suspended sediments, *Fish Creek, *New York, Shear stress, Flow velocity, Meyer-Peter-Muller equation, Toffaleti equation, Mathematical equations.

Two bed load equations were evaluated in sand-bottomed channels by measuring the hydraulic data required for the formulas and the actual sediment transport rate and comparing the calculated values with values observed in the Fish Creek, Rome, New York. Over a two year period 81 samples were collected. Data was smoothed by placing the samples in order of their sediment transport rates and averaging each set of five neighboring values. The Toffaleti (1969) equation produced the better agreement between predicted and measured bed loads. The data showed a scatter of a factor of 2.5, probably a result of the effects of grain size, water depth, and temperature on the shape of the local energy grade line used in the procedure or the randomness of the bed load. The Meyer-Peter and Muller (1948) equation, a threshold type, was not suitable for sand-bed channels. Predictions were significantly higher than measured sediment transport rates. In some cases movement was observed where zero movement was predicted. (Cassar-FRC)
W82-02375

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1977-79,
Geological Survey, Anchorage, AK. Water Resources Div.
R. L. Burrows, W. W. Emmett, and B. Parks.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A105363, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-20, 1981. 56 p, 20 Fig, 29 Tab, 9 Ref.

Descriptors: *Sediment transport, *Bed load, *Particle size, Streamflow, Suspended sediments, Sediment discharge, Flow rates, Hydrologic data, *Alaska, Fairbanks, *Tanana River.

Suspended sediment and bedload transport rates for the Tanana River near Fairbanks, Alaska, can be related to water discharge, and annual sediment loads can be computed using these relations. For a site near Fairbanks, the average annual (1974-79) load is 24 million metric tons of suspended sediment and 321,000 metric tons of bedload. Upstream, near North Pole, the average annual load is 20.7 million metric tons of suspended sediment and 298,000 metric tons of bedload. For both sites bedload is usually 1 to 1.5 percent of suspended sediment load. Particle size distribution of suspended sediment is similar at Fairbanks and North Pole. Median particle size is generally in the silt range, but at some low-water discharges, it is in the very fine sand range. Median particle size of bedload near North Pole is generally in the gravel range, but at some low transport rates, it is in the medium sand range. In 1977 median bedload particle size was comparable at the two sites, but in 1978 the median size was markedly smaller at Fairbanks. In 1979, generally coarser material was transported at both sites, but the decrease in bedload particle size was even greater between the sites. At both sites and at all water discharge and sediment transport rates, suspended load particles are significantly smaller than bedload particles. At North Pole in 1979, median bed material particle size was in the course gravel range; at Fairbanks it was in the medium gravel range in the main channel but in the fine sand range in the overflow part of the channel. (USGS)
W82-02472

CUMULATIVE EFFECTS OF LOGGING ROAD SEDIMENT ON SALMONID POPULATIONS IN THE CLEARWATER RIVER, JEFFERSON COUNTY, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
C. J. Cedarholm, L. M. Reid, and E. O. Salo.
In: Proceedings from the Conference, Salmon Spawning Gravel: A Renewable Resource in the Pacific Northwest, October 6-7, 1980, Seattle, State of Washington Water Research Center, Washington State Univ., Pullman, Rept No 39, March, 1981. p 38-74, 10 Fig, 7 Tab, 44 Ref.

Descriptors: *Sediment control, *Rivers, *Spawning, *Salmon, *Gravel, Fish management, Logging, Detritus, Catchment areas, Ecological effects, Landslides, Forestry, Road construction, Access routes.

In 1971 a series of massive landslides on the west coast of the Olympic Peninsula, which included both logging and road sidecast failures, prompted research on the sedimentation of salmonid spawning habitats. The sedimentation from logging road activities has caused long-term concern for fisheries resources of the Clearwater River. This study included analyses of field situations supplemented by controlled experiments. Significant amounts (15-25 percent) of fine sediments (less than 0.85 mm diameter material) are accumulating in spawning gravels of some heavily roaded tributary basins. This accumulation is highest where the road area exceeds 2.5 percent of the basin area. Tributaries of relatively steep gradient are less likely to accumulate high levels of fines. The survival of salmonid eggs to emergence is inversely correlated with percent fines when the percentage of fines exceeds the natural level of 10 percent. The presence of 2.5 km/km-squared of gravel-surfaced roads undergoing an average distribution of road uses is found to be responsible for producing sediment at 2.6 to 4.3 times the natural rate in a drainage basin. Sixty percent of the road-related sediment production is caused by landslides, while 18-26 percent is caused by erosion on road surfaces. However, if fine sediment alone is considered, the production from road surfaces and landslides is nearly equal. (Garrison-Omniplan)
W82-02507

MT. ST. HELENS AND THE FISH,
Washington State Dept. of Fisheries, Olympia.
W. Rees.
In: Proceedings from the Conference, Salmon Spawning Gravel: A Renewable Resource in the Pacific Northwest. Oct 6-7, 1980, Seattle. State of Washington Water Research Center, Washington State Univ., Pullman. Rept. No 39, March, 1981. p 168-175. 1 Fig, 1 Tab.

Descriptors: *Volcanoes, *Fishkill, *Salmon, *Stream fisheries, *Sediment concentration, Economic aspects, Landslides, Gills, Fish hatcheries, Mudflows, Turbidity, Sediment control.

The Mt. St. Helens eruption in May 1980, signalled by an earthquake of magnitude 5, was a direct lateral explosion---the worst of all types of volcanic eruptions. The blast was followed by pyroclastic flows that in turn touched off mudslides affecting rivers up to twenty miles away. Observations in the Cowlitz River indicated that the new sediment deposit was 12 to 15 feet deep throughout the Cowlitz channel and had reduced the channel's capacity by about 85 percent. Significant quantities of sediment were also carried out into the Columbia River, destroying the navigational channel in some locations. All fish were killed in the mainstem Toutle River and its North and South Forks, as well as in the lower 20 miles of the Cowlitz River. In addition, the Toutle Hatchery was inundated and suffered a loss of juvenile salmon. This loss of salmon represents a direct economic loss of over $7.5 million to fisheries. Seven major hatcheries in the area have been affected by the eruption. Mortalities to juvenile salmon held in live boxes since the eruption have ranged from 100 percent mortality in less than six hours to 100 percent survival in some areas during a low flow period. Mortality to juveniles and adults is due to gill abrasion, and increases with higher turbidity. Temporary rehabilitation efforts are underway, but long-term effects cannot be quantified at this time. (Garrison-Omniplan)
W82-02508

CHARACTERIZATION OF SPAWNING GRAVEL AND STREAM SYSTEM EVALUATION,
Corvallis Environmental Research Lab., OR.
M. A. Shirazi, W. K. Seim, and D. H. Lewis.
In: Proceedings from the Conference Salmon Spawning Gravel: A Renewable Resource in the Pacific Northwest. Oct 6-7, 1980, Seattle. State of Washington Water Research Center, Washington State Univ., Pullman. Rept No 39, March 1981. p 227-278. 5 Fig, 8 tab, 18 Ref, Append.

Descriptors: *Sediment control, *Stream fisheries, *Salmon, *Spawning, *Gravel, Stream erosion, Particle size, Landslides, On-site data collections, Forestry, Logging, Detritus, Ecological effects, Streams, *Pacific Northwest.

As a result of silviculture activities in the Pacific Northwest, various levels of sediments and debris enter the streams, degrading spawning substrate of salmonid fishes. To provide a unifying methodology for monitoring and assessing stream gravel composition, an experiment was conducted in the summer of 1978 that addressed gravel composition differences at a variety of spawning substrates, using sites from ten to several hundred square meters in size. Included in the study were streams in the Siuslaw National Forest in Oregon, a segment of the Rogue River in Oregon, and a small salmon stream in southeast Alaska. It was found that the mean geometric particle diameter provides a convenient and theoretically sound parameter that expresses the entire range of the particle distribution and effectively relates particle size to salmonid embryo survival. Thus, the mean geometric particle diameter is preferable to percent fines. Either manual core or freezecore samplers are adequate when properly used. Sample depth should be 25 cm; single freezecores or manual cores less than 15 cm in diameter may give inadequate sample size in coarse substrates. Sieve series should follow the series in millimeters from 64 to .063. Also recommended is a combination of visual estimation and actual sampling. Comparison between existing and expected normal background sediment characteristics will provide the basis of assessing spawning habitats. (Garrison-Omniplan)
W82-02509

HYDRAULICS OF FLOW AND SEDIMENT TRANSPORT IN THE KANKAKEE RIVER IN ILLINOIS,
Illinois State Water Survey, Champaign.
N. G. Bhowmik, A. P. Binini, W. C. Bogner, and R. P. Byrne.
Illinois Institute of Natural Resources Report of Investigation 98, 1980. 132 p, 80 Fig, 14 Tab, 92 Ref, 17 Append.

Descriptors: *Sediment transport, *River basins, *Flow measurement, *Flow rates, Deposition, Rivers, Gaging stations, Low flow, Scour, Sedimentation, Flood peak, Sandbars, Channeling, Streamflow, Flood flow, *Kakakee River, Illinois.

Detailed hydraulic and geometric data were collected from various locations along the Kankakee River to study the mechanics of flow and the sediment transport capability of the river. An historical review of the river basin over the last few hundred years showed the progression of the river channelization in Indiana about 65 years ago, as well as the behavior of the river in the straigtened portion in Indiana and the nonstraigtened portion in Illinois. An analysis of the historical data related to peak flows, average flows, and low flows for six gaging stations showed a trend of increasing peak flows at Shelby and Momence, with a similar trend of increasing average flows at Momence and Wilmington. Deposition and scour occurred at various places in the main stem of the river in Illinois between 1968-1978. An analysis of more than 300 bed material samples indicated that the median diameters of the bed materials of the river range in size from 0.2 to 0.4 mm. During flood season, for a period of about 60 to 80 days, the river carries 70 to 80 percent of the yearly sediment load at all the gaging stations. The Iroquois River watershed contributed more suspended sediment lead per square mile of drainage area than the main stem of the Kankakee River. A number of active sand bars were surveyed, and one near the state line appears to be forming and crossing the state line once a year. A number of preventive and remedial measures were suggested, with preference for the preventive approach, to reduce the sediment load in the river. (Garrison-Omniplan)
W82-02512

VELOCITY PROFILES WITH SUSPENDED SEDIMENT,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
N. L. Coleman.
Journal of Hydraulic Research, Vol 19, No 3, p 211-229, 1981. 10 Fig, 3 Tab, 27 Ref.

Descriptors: *Velocity coefficients, *Suspended sediments, Karman coefficient, Channel flow, Open channels, Richardson number, *Open channel flow.

Experiments were conducted on the effect of suspended sediment on velocity profiles. The findings indicate that the Karman coefficient does not decrease with increasing suspended sediment concentration, even though the velocity profile does respond to the presence of suspended sediment by changing shape. The currently accepted forms of the law of the wall and the velocity defect law contain wake flow terms in addition to the original Prandtl-Karman forms. These terms account for the deviation of the velocity defect laws from the logarithmic form in the outer part of the boundary layer in an open channel flow. The existence of these terms emphasizes the need to evaluate the Karman coefficient from straight line fits to experimental velocity profiles in the lower 15% of the flow, in the region where the wake flow terms are negligible, and not out in the more central regions of the flow. The Karman coefficient remained essentially constant over a range of conditions from flows with no sediment in suspension to flows carrying a near capacity load of suspended sediment. The new data also shows that the wake strength coefficient, for uniform nonseparating flows, varies directly with the gross-flow Richardson number. This indicates the presence of suspended sediment capable of reducing turbulence effects in the outer part of the flow. (Baker-FRC)
W82-02581

2K. Chemical Processes

LAKE ERIE NEARSHORE WATER CHEMISTRY AT NANTICOKE, ONTARIO, 1969-1978,
Ontario Ministry of the Environment, Toronto. Water Resources Branch.
I. W. Heathcote, R. R. Weiler, and J. W. Tanner.
Journal of Great Lakes Research, Vol 7, No 2, p 130-135, 1981. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Water analysis, *Lakes, *Lake Erie, Ontario, *Nanticoke, Nearshore processes, Water chemistry, Phosphorus, Nitrogen, Seasonal variation, Environmental effects, *Chemical analysis.

The results and conclusions of the first 10 years of the Nanticoke water chemistry program are reviewed. The authors of the Nanticoke water chemistry reports used a fixed-factor, two-way analysis of variance without replication to assess the significance of between-date and between-station variability in the levels of water chemistry parameters. Additional statistical methods were employed in this study to elucidate spatial variability in the Nanticoke water chemistry data. No significant long-term trends were found in phosphorus levels in the nearshore waters of Lake Erie at Nanticoke. Despite total phosphorus concentrations of almost 20 micrograms/liter, the area around Nanticoke and Long Point Bay is the only region in Lake Erie that is classified as being in the oligotrophic to mesotrophic range on the basis of total phosphorus, chlorophyll a, and Secchi disk transparency. This is attributed to the influence of the open lake circulation east of Long Point and to a drainage basin that does not contribute much phosphorus and sediment to the lake. All the water quality parameters measured at Nanticoke have met the Ontario and IJC water quality objectives for at least the four years from 1975 to 1978. While water chemistry was similar at all the Nanticoke sampling stations, the stations fell into offshore and nearshore groups on the basis of differences in Secchi disk transparency and total Kheldahl nitrogen. Levels of most water chemistry parameters varied with the seasons. Specific conductance, chloride, and turbidity decreased over the 10 yr study. Phytoplankton density increased. Temperature, dissolved oxygen, pH, nitrate plus nitrate, Kjeldahl nitrogen, ammonia, total phosphorus and filtered reactive phosphorus did not change significantly. (Baker-FRC)
W82-02228

CHEMICAL AVAILABILITY OF CADMIUM IN MISSISSIPPI RIVER SEDIMENT,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
For primary bibliographic entry see Field 5B.
W82-02267

SOME ANALYSES OF AQUATIC PLANTS AND THEIR WATERS,
Crewe and Alsagar Coll. of Higher Education (England).
For primary bibliographic entry see Field 2H.
W82-02293

CHEMISTRY OF INTERSTITIAL WATER AND BOTTOM SEDIMENTS AS INDICATORS OF SEEPAGE PATTERNS IN PERCH LAKE, CHALK RIVER, ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2A.
W82-02304

INTERACTIONS BETWEEN LUGOL'S FIXATIVE AND ETHYLENE IN THE ACETYLENE-REDUCTION ASSAY FOR NITROGENASE ACTIVITY IN LAKE WATER,
Lund Univ. (Sweden). Limnological Inst.
L. Leonardson.
Canadian Journal of Microbiology, Vol 26, No 5, p 599-605, 1980. 5 Fig, 5 Tab, 11 Ref.

Descriptors: *Chemical analysis, Sample preservation, Nitrogen fixation, Nitrogen, Enzymes, *Lakes, Chemical reactions, *Ethylene, *Phytoplankton, Byajon Lake, *Sweden.

For performing the acetylene-reduction assay of nitrogenase activity in aquatic organisms, Lugol's solution is a practical and efficient fixative. However, correction must be made for the solubility of ethylene in the liquid phase and reactions between Lugol's solution and ethylene. The purpose of this study was to determine the extent of the loss of ethylene and the effects of phytoplankton concentrations and storage conditions. Water for the study was taken from Lake Byajon in Scania, Sweden. The studies indicated that the solubility of ethylene in the liquid phase of samples cannot be neglected if a realistic assessment of aquatic nitrogen fixation is desired. Since ethylene is unsaturated and highly reactive, care must be taken to use reagents that will inhibit the nitrogenase enzyme. Both solubility and chemical reactions contribute to the decrease of the ethylene content of the vapor phase during long-term storage. The loss of ethylene to mixtures of water and Lugol's solution can be overcome by using a standardized technique and storing samples under defined conditions until analysis. The true ethylene production in the incubation vessel can then be calculated after determination of solubility and long-term reaction patterns for the actual experimental design. (Baker-FRC)
W82-02380

MAJOR ION CHEMISTRY IN A TROPICAL AFRICAN LAKE BASIN,
Nairobi Univ. (Kenya). Dept. of Botany.
J. J. Gaudet, and J. M. Melack.
Freshwater Biology, Vol 11, No 4, p 309-333, August, 1981. 10 Fig, 14 Tab, 64 Ref.

Descriptors: *Lake basins, *Chemical analysis, Sodium, Chemistry of precipitation, Africa, Calcium, Sulfates, Chlorides, Water analysis, Precipitation, Sediments, Tropical zone, Tropical regions, Climatic zones, Rainwater, *Lake Naivasha, *Kenya, *Chemical composition.

The object of this research was to quantify differences in chemical composition of waters of the Naivasha basin. The basin lies between the two flanks of the Eastern or Gregory Rift Valley. Lake beds are composed of reworked volcanic material

or subaqueously deposited pyroclastics and organic matter produced locally. The climate is warm and semi-arid. The lake area has become an important area for intensive vegetable production under irrigation. The Naivasha basin contains four topographically distinct bodies of water. The mean chemical composition in mg/liter of bulk precipitation collected on two transects across the rift valley near Lake Naivasha and at three stations near Nairobi was: Na, 0.54; K, 0.31; Ca, 0.19; Mg, 0.23; sulfate, 0.72; and chloride, 0.41. The major inflow was largely a solution of bicarbonate, sodium, and calcium and carried a total dissolved solids load of 62 kg/ha in 1973 and 120 kg/ha in 1974. Among standing waters sodium and bicarbonate predominated; the total dissolved solute content increased from a low under the northern papyrus swamp to intermediate in Lake Naivasha to a high in Oloidien Lake. The freshness of Lake Naivasha was due to a large fraction of water in the lake coming from dilute rivers and rain. The fact that the lake does not lie in a closed basin but loses water and solutes through seepage, and that exchange with sediments in both the pelagic and littoral regions is a major route for solute movement leading to accumulation on the lake bottom. (Baker-FRC)
W82-02440

GEOCHEMICAL EVIDENCE ON THE NATURE OF THE BASEMENT ROCKS OF THE SIERRA NEVADA, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
I. Barnes, R. W. Kistler, R. H. Mariner, and T. S. Presser.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25 in paper copy. Geological Survey Water-Supply Paper 2181, 1981. 13 p, 6 Fig, 7 Tab, 70 Ref.

Descriptors: *Geochemistry, *Foundation rocks, *Springs, *Carbon dioxide, Geohydrology, Geologic formations, Geologic control, Stable isotopes, Water analysis, Chlorides, Water quality, Chemical analysis, *California, Sierra Nevada Mountains, Klamath Mountains, Batholith.

Carbon dioxide-rich waters from 10 of 17 sampled Sierra Nevada soda springs have high concentrations of magnesium, are saturated with amorphous silica, and have temperatures near the mean annual air temperature. This combination is unique to the phase assemblage serpentine-water-carbon dioxide and requires either an isothermal gradient in the ground water and adjacent rocks or shallow depth to the serpentinite. Magnesium concentrations are lower than those found in soda spring water under similar physical and chemical conditions in lizardite-chrysotile serpentinite terranes; therefore, the serpentinites under the Sierra Nevada may be antigorite. Calcium concentrations are in the range of 120 to 620 mg/L probably from calcite-bearing rocks being dissolved by the water; the strontium-isotope values for some of the spring waters are consistent with the calcite being of Middle Devonian to early Mesozoic age. Low strontium-isotope values suggest that the metamorphic rocks beneath the plutons are free of muscovite because carbon dioxide-rich waters that issue from metamorphic rocks containing both biotite and muscovite have much higher strontium-isotope values than waters that issue from granitic rocks containing biotite but no muscovite. The waters have deuterium and oxygen-18 values identical with modern meteoric water but contain high chloride concentrations (up to 2500 mg/L). This combination requires mixing of meteoric waters with a brine of at least 100,000 mg/L chloride. Such brines are usually found in clastic rocks of marine origin. High boron (up to 33 mg/L) and readily detectable bromide and iodide confirm the presence of marine clastic rocks (now metamorphosed) beneath 11 of the springs. (USGS)
W82-02460

GROUND-WATER DATA FOR MICHIGAN 1980,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W82-02467

CHEMICAL QUALITY OF GROUND WATER IN SAN JOAQUIN AND PART OF CONTRA COSTA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. K. Sorenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-124330, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-26, June, 1981. 32 p, 9 Fig, 8 Tab, 14 Ref.

Descriptors: *Water quality, *Groundwater, *Chemical analysis, *Wells, Water sampling, Geohydrology, Water use, Water quality standards, Trace elements, Water types, *California, Sacramento Valley, San Joaquin County, Contra Costa County.

Chemical water-quality conditions were investigated in San Joaquin and part of Contra Costa Counties by canvassing available wells and sampling water from 324 representative wells. Chemical water types varied, with 73 percent of the wells sampled containing either calcium-magnesium bicarbonate, or calcium-sodium bicarbonate type water. Substantial areas contain ground water exceeding water-quality standards for boron, manganese, and nitrate. Trace elements, with the exception of boron and manganese, were present in negligible amounts. (USGS)
W82-02470

130,000-YR CONTINUOUS POLLEN RECORD FROM CLEAR LAKE, LAKE COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA.
D. P. Adam, J. D. Sims, and C. K. Throckmorton.
Geology, Vol 9, No 8, p 373-377, August, 1981. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Lake sediments, *History, *Climatology, Trees, *Pollen, Sediments, Sampling, Cores, Clear Lake, California.

A pollen analysis of core 4 (a 115 m core) sediment from Clear Lake, California, revealed a climatic record that was continuous for 130,000 years. Migrations of the tree species of the california coast Ranges were seen in response to climatic changes due to the glacial cycle. The 165 samples from the 115-m core indicated that during interglacials, pollen in rain was dominated by oak, while in cooler periods it was dominated by pine. The natural vegetation in the area at present is a blue oak-digger pine forest. The curve for oak pollen over the 130,000 years resembled and can be correlated with both deep-sea oxygen-isotope curves and the climatic record from certain European pollen studies. (Small-FRC)
W82-02544

GEOCHEMISTRY OF AMINO ACIDS IN SEDIMENTS FROM CLEAR LAKE, CALIFORNIA,
Geological Survey, Menlo Park, CA.
D. J. Blunt, K. A. Kvenvolden, and J. D. Sims.
Geology, Vol 9, No 8, p 378-382, August, 1981. 3 Fig, 3 Tab, 21 Ref.

Descriptors: *Lake sediments, *Geochemistry, *Amino acids, Geologic history, *Pollen, Clear Lake, California, Sampling, Sediments, Cores.

The results of amino acid geochemistry are reported with application to deochronology in core 4 sediments of Clear Lake (California). Aspartic acid and alanine were considered in detail to clarify uncertainties in correlations of ash beds and pollen spectra in lacustrine sediment. Relative concentrations of aspartic acid decreased with depth, probably due to diagenesis and to preferential adsorption and hydrolysis in clay. Alanine increased with depth, probably because of the generation of alanine during diagenesis of other amino acids. When age assessment is based on alanine, results support a time-depth curve obtained from oak pollen and oxygen isotopes over a span of about 130,000 years. (Small-FRC)
W82-02545

ELECTRON INTENSITY, THE ROLE OF HUMIC ACIDS IN EXTRACELLULAR ELECTRON TRANSPORT AND CHEMICAL DETERMINATION OF PE IN NATURAL WATERS,
Toronto Univ. (Ontario). Dept. of Zoology.
A. P. Zimmerman.
Hydrobiologia, Vol 78, No 3, p 259-265, 1981. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Humic acids, *Oxidation-reduction potential, Electron transport, Organic matter, Organic acids, Chemical potential, Lake sediments, Lakes, Sediments, Chelation, Mercury, *Georgia.

Humic acids were capable of accepting and donating electrons across a wide range of potentials (-1.2 to +0.8 V), including the entire range encountered in aquatic systems. Evolution of Hg, using Hg(NO3)2 as the terminal electron acceptor, was highest, 60%, in the combination, humic acid plus SnC12. Hg evolution in other flasks was as follows: control (Hg alone), sediments, humic acids, sediment plus NaBH4, and humic acids plus NaBH4, all < 10%; SnC12, NaBH4, ascorbic acid, each 10-20%; sediment plus ascorbic acid, 35%; and sediment plus SnC12 and humic acids plus ascorbic acid, 30-40%. In biological systems Hg evolution after 168 hours varied between 2 and 12% in the increasing order: low Hg, high Hg, low Hg plus sucrose, low Hg plus humic acids, high Hg plus humic acids, high Hg plus sucrose, low Hg plus humic acids plus sucrose, and high Hp plus humic acids plus sucrose. In the case of humic acid complexes with 2-p-iodophenyl-3-nitrophenyl-5-phenyltetrazolium chloride (INT), an electron sensitive dye, the pE is dependent only on the negative log of the ratio of oxidized to reduced dye. PE's were chemically determined for sediments in 3 Georgia lakes. They were: Jackson (highly productive, heavy sediment loads), -10 to +4; Burton (dilute, low ionic strength), 0 to +5; and louise (acidic, with organic ligands), 0 to +4. (Cassar-FRC)
W82-02566

WATER QUALITY OF A SOUTHEAST TEXAS STREAM,
Lamar Univ., Beaumont, TX. Dept. of Biology.
D. Bass, and R. C. Harrel.
Hydrobiologia, Vol 76, 1/2, p 69-79, 1981. 1 Fig, 5 Tab, 21 Ref.

Descriptors: *Water quality, *Streams, Chlorides, Bacteria, Coliforms, Feces, Benthos, Runoff, Rainfall, Dissolved oxygen, Seasonal variation, Baseline studies, *Menard Creek, Polk County, *Texas.

A determination was made of baseline water quality data in Menard Creek, with attempts to establish downstream and seasonal trends in water quality and locate existing and potential sites of pollution. Menard Creek originates in central Polk County of southeast Texas and flows 77 km through Hardin and Liberty counties into the Trinity River. The vegetation is that characteristic of the river floodplain forest and slope forest of the Big Thicket, a National Preserve. Samples were taken from Menard Creek during July 1978 to June 1979. In general the physicochemical conditions indicated good water quality. Menard Creek was characterized by an intermediate number of taxa (12) and intermediate to high species diversity. Depression in diversity was directly related to high discharge and not to poor water quality. The fauna was composed of large numbers of pollution intolerant taxa and many more insects than oligochaetes. Numbers of fecal bacteria were higher than acceptable for contact recreation at all sampling stations during much of the study period. Highest numbers were generally found after heavy rains and surface runoff. Fecal coliform to fecal streptococci ratios indicated human contamination in 53% of the 60 samples, while non-human contaminations were found in 12% of the samples. Dissolved oxygen concentrations were always high, and all other parameters were within the expected ranges for small streams in the area. Conductivity and chlorides indicated low concentrations of oil field brines at two sampling sites. (Baker-FRC)
W82-02570

2L. Estuaries

FRESHWATER INPUTS AND ESTUARINE PRODUCTIVITY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
S. W. Nixon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol I, October, 1981. p 31-57, 8 Fig, 5 Tab, 86 Ref.

Descriptors: *Estuarine environment, *Primary productivity, *Eutrophication, *Nutrients, Water circulation, River flow, Wetlands, Salt marshes, Secondary productivity.

The processes responsible for the high level of production characteristic of estuarine systems are not yet well understood. There are at least five major hypotheses which have been put forward to account for estuarine production, including the fertilizing effect of nutrients in fresh water, advection of nutrient rich offshore water, the trapping of nutrients in estuarine circulation, the outwelling of nutrients from salt marshes and other wetlands, and the rapid recycling of nutrients within the estuary. The remarkable similarity of primary and (to a lesser degree) secondary production levels among estuaries with widely varying fresh water inputs, hydrodynamic properties, and geographical and geological characteristics suggests that a more general feature of estuarine systems is most important in enhancing production in these areas. While river inputs may contribute to the spring bloom, most of the production in many estuaries appears to take place during the warmer months and to be supported by recycled nutrients. Because remineralization appears to be a slower process than the formation of new organic matter, it may be that heterotrophic processes play an important role in regulating the primary production of estuaries, and that the similarity of carbon fixation rates in various estuaries arises because of some common limit on the rate of nutrient recycling. More attention also needs to be given to the problem of understanding the relationship between short-term processes, such as annual production or regeneration, and longer term processes, such as the continuous input of nutrients from rivers and anthropogenic sources. (Moore-SRC)
W82-02110

CHESAPEAKE BAY LOW FRESHWATER INFLOW STUDY,
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 6G.
W82-02114

ASPECTS OF IMPACTS ASSESSMENT OF LOW FRESHWATER INFLOWS TO CHESAPEAKE BAY,
Western Ecosystems Technology, Laurel, MD.
For primary bibliographic entry see Field 6G.
W82-02115

FRESHWATER INFLUENCES ON STRIPED BASS POPULATION DYNAMICS,
Maryland University, Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 6G.
W82-02116

EFFECTS OF FRESHWATER FLOW ON SALINITY AND PHYTOPLANKTON BIOMASS IN THE LOWER HUDSON ESTUARY,
Lamont-Doherty Geological Observatory, Palisades, NY.
P. J. Neale, T. C. Malone, and D. C. Boardman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 168-184, 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Estuarine environment, *Salinity, *Phytoplankton, *River flow, *Model studies, Water currents, Low flow, High flow, Biomass, Chlorophyll a, Tidal effects, *Hudson River estuary.

Phytoplankton biomass variations in estuaries are primarily the result of material fluxes due to estuarine circulation and fluxes due to biological and particulate processes (growth, sinking, and grazing). Thus freshwater effects on estuarine circulation can be translated to effects on phytoplankton biomass if the relative contribution of circulation-related fluxes is known. A two dimensional box model was used to describe variation of phytoplankton biomass in the lower Hudson Estuary under different flow conditions. Both the flux contribution of estuarine circulation and other gain or loss processes are quantified by the model. Lag between gauging data and freshwater flow in the estuary, the vertical structure of current velocity and salinity, and the tidal variation of salinity in each layer were considered in the estimation of model parameters. Results indicate that estuarine circulation was strong and flushing times relatively short under both high and low flow conditions. Biomass fluxes in terms of chlorophyll a were dominated by boundary inputs during high flow and by growth and grazing during low flow. The good agreement found between independent measurements of specific rates and specific rates estimated from the model indicates that the model gives a reasonable description of estuarine phytoplankton processes, and may be applicable in other estuaries. (Moore-SRC)
W82-02117

ATCHAFALAYA DELTA: SUBAERIAL DEVELOPMENT; ENVIRONMENTAL IMPLICATIONS AND RESOURCE POTENTIAL,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2J.
W82-02126

A NEW APPROACH TO DETERMINING THE QUANTITATIVE RELATIONSHIP BETWEEN FISHERY PRODUCTION AND THE FLOW OF FRESH WATER TO ESTUARIES,
National Marine Fisheries Service, Miami, FL. Southeast Fisheries Center.
For primary bibliographic entry see Field 4C.
W82-02130

AN EVALUATION OF AQUATIC LIFE FOUND AT HYDRAULIC SCOUR SITES IN THE COLUMBIA RIVER ESTUARY SELECTED FOR POTENTIAL SEDIMENT DEPOSITION,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
J. T. Durkin, T. C. Coley, K. Verner, and R. L. Emmett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, Texas, Sept. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol. I, October, 1981, p 436-452. 7 Fig, 4 Tab, 8 Ref.

Descriptors: *Aquatic animals, *Estuarine environment, *Scour, *Sediment erosion, *Flushing, Spoil disposal, Tidal effects, Fish, River flow, *Columbia River estuary.

Substantial scouring of estuarine sediment occurs from flushing of the Columbia River, which has an annual spring freshet of 20,300 cu m/s. The effect is heightened by diurnal marine water intrusion combined with spring tides having ranges exceeding 3 M. Estuarine depth is maintained by these forces at the end of jetties, promontories, and adjacent bridge openings. Hydraulic stress in these areas suggests biological instability, a low standing crop and occupancy by species tolerant of such physical conditions. Because inwater sediment disposal at sites with low biological activity is preferable to deposition at biologically rich and stable sites, scour sites were investigated for potential dredge deposition. Biological inventories of aquatic life were conducted in October-November 1978 and May 1979, at four diverse scour sites in the Columbia River Estuary. Benthic fauna, epifauna, and pelagic fish were studied as well as food utilization of dominant finfish. Inventory studies indicated low suitability for sediment deposition due to biological richness at the Tonuge point and Interstate Bridge sites. Jetty A site was biologically poor, and has potential suitability as a deposition site. Tansy Point site may be suitable for deposition at predetermined times. Inventory evaluation studies should be tested under controlled deposition conditions preceding sustained usage. (Moore-SRC)
W82-02132

THE EFFECTS OF FRESHWATER INFLOW ON SALINITY AND ZOOPLANKTON POPULATIONS AT FOUR STATIONS IN THE NUECES-CORPUS CHRISTI AND COPANO-ARANSAS BAY SYSTEMS, TEXAS FROM OCTOBER 1972-MAY 1975,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 6G.
W82-02133

NUTRIENT FLUX BETWEEN THE NUECES DELTAIC MARSH AND THE NUECES ESTUARY ON THE TEXAS GULF COAST,
North Texas State Univ., Denton. Inst. of Applied Sciences.
D. P. Wilcox, and W. M. Childress.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the Nat'l Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Serv., Office of Biological Svs. Rept FWS/OBS-81/04, Vol I, Oct. 1981, p 472-487. 5 Fig, 2 Tab, 19 Ref. 14-16-0009-77-074.

Descriptors: *Nutrients, *Estuaries, *Tidal marshes, *Tidal effects, Carbon Nitrogen, Phosphorus, Seiches, Seasonal variation, Fluctuations, *Texas.

Movements of carbon, nitrogen, and phosphorus in the surface waters between a tidal marsh and the Nueces estuary, Nueces County, Texas, were studied over an 8-month period (October 1978-June 1979). Nutrient transport in the Nueces marsh appears to be rather atypical when compared to other high salinity riverine marsh systems. It is characterized by infrequent and incomplete inundation by both flood and tidal waters and tends to serve as a nutrient sink. Seasonal patterns in nutrient flux were evident throughout the study period. Net fluxes of virtually all nutrient parameters were directed out of the marsh during the fall and winter, but were directed into the marsh during the spring. Combined net input of C, N, and P in the spring and summer ranged from 33 to 571 kg/hr. Tidal fluctuations in the Nueces estuary are normally low (0-60 cm). Nutrient concentrations within a tide are not as critical to the determination of net flux as is the flow rate between flood and ebb tides. Flows in and out of the marsh are for the most part attributable to tidal action, and to a lesser extent to wind seiche. (Moore-SRC)
W82-02134

ESTUARINE BENTHIC COMMUNITY DYNAMICS RELATED TO FRESHWATER INFLOW TO THE CORPUS CHRISTI BAY ESTUARY,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
R. W. Flint, and S. C. Rabalais.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Fresh-

water Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol I, Oct. 1981, p 489-508. 11 Fig, 15 Ref.

Descriptors: *Estuarine environment, *Salinity, *Rainfall, *Benthic fauna, Shrimp, Streamflow, Runoff, Biomass, Productivity, Nutrients, *Corpus christi Bay estuary Texas.

During the 24-hr period beginning with the evening of 18 September 1979, an extensive low pressure system engulfed the south Texas coast and heavily impacted the Corpus Christi area with tropical storm-intensity rains that reached as much as 33 cm accumulation in 24 hr. This produced a large amount of riverine input and land runoff to Corpus Christi Bay, dramatically decreasing salinity below normal levels for more than a month. The existence of an historical data base on benthic infauna for this estuary allowed an investigation to be conducted concerning effects of this intensive freshwater inflow on the estuarine benthos. Several months after the inflow event, densities of dominant infaunal populations increased to levels never observed, and productivity of the benthos, as represented by biomass changes, increased substantially over previous years. The nutrients associated with the intense freshwater inflow may have increased the primary productivity of the estuarine ecosystem. The increased productivity was, in turn, eventually reflected by the benthos. These data may provide a missing link in the correlations between freshwater inflow events in south Texas estuaries and yields of some of the important fisheries, such as shrimp. (Moore-SRC)
W82-02135

THE EFFECTS OF FLOODS ON THE ZOOPLANKTON ASSEMBLAGE OF SAN ANTONIO BAY, TEXAS DURING 1972 AND 1973,
National Marine Fisheries Service, Galveston, TX.
G. A. Matthews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol I, Oct. 1981, p 509-525. 6 Fig, 3 Tab, 5 Ref.

Descriptors: *Zooplankton, *Estuarine environment, *Floods, *Salinity, Flushing, Aquatic animals, Environmental effects, Floodwater, Population density, *San Antonio Bay, Texas.

With the increasing use of estuaries for various economic purposes, it has become essential to know what to expect when certain environmental factors change. In order to study the effects of floods on an estuary, plankton tows and hydrographic measurements were taken encompassing a single flood in 1972, and three floods in 1973 in San Antonio Bay, Texas. The shallow bay was rapidly flushed by influx of flood waters as was indicated by reductions in salinity and in the densities of the dominant species, Acartia tonsa. Floods replaced the typical estuarine zooplankters with freshwater ones. During the 1972 flood, total zooplankton densities fell from 10,800/cu m before the flood to 3,400/cu m after the flood, but they increased rapidly when the river flow returned to base level. After the three floods in 1973, a cumulative decrease in total density of over two orders of magnitude was found. There had been insufficient time to reestablish pre-flood densities between each flood. The rapidity with which densities were reestablished and the areas in which these increases were first found indicates the majority of the density changes were due to influx of zooplankton-rich bay water from Espiritu Santo Bay, rather than from population explosion by surviving refuge populations. The seasonal occurrence of a flood may severely reduce the survival of a bay's annual recruitment of economically important species whose larval stages are members of the zooplankton or which depend on zooplankton as food. It is important to note the interdependency of these estuaries, as currents carry life from one into the next. (Moore-SRC)
W82-02136

THE INFLUENCE OF SALINITY TRANSITION ON BENTHIC NUTRIENT REGENERATION IN ESTUARIES,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
R. E. Edwards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service. Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 2-16. 78 Ref.

Descriptors: *Salinity, *Nutrients, *Regeneration, *Benthic environment, *Estuaries, Mineralization, Cycling nutrients, Sediments.

Sediment nutrient regeneration can be divided into three categories of processes: mineralization, mobilization, and release. Mineralization occurs primarily through biological processes, so any salinity effect on benthic metabolism will affect mineralization. Salinity transition can influence mobilization directly through physical/chemical mechanisms or indirectly through its effects on biological functioning. The predominant release process is molecular diffusion which is affected only indirectly by salinity transition, but it does significantly affect the release processes of convective overturn, bioturbation, and ebullition. Because of the complexity of the interrelationships and the lack of data few generalizations can be made. The effects of salinity transition should be a function of the absolute value of the salinity change, and the rate of change. Transition to increased salinity should cause more rapid change and more immediate changes in nutrient regeneration. Salinity transition is expected to have the greatest impact in the oligohaline (0.5 - 5.0 ppt) portion of the estuary, as the benthic organisms in this environment are the most sensitive to salinity changes. (Brambley-SRC)
W82-02137

MONITORING FRESHWATER INFLOW TO ESTUARIES BY REMOTE SENSING,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
For primary bibliographic entry see Field 7A.
W82-02138

CONCENTRATION, EXTENT, AND DURATION OF SALINITY INTRUSION INTO THE COLUMBIA RIVER ESTUARY, SEPTEMBER-OCTOBER, 1977-1978,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. J. McConnell, G. R. Snyder, J. T. Durkin, and T. H. Blahm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 41-53. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Saline water intrusion, *Columbia River estuary, *River flow, *Tides, *Estuaries, Data acquisition, Dredging, Environmental effects, Aquatic life, Estuaries.

Salinity intrusion studies were conducted in 1977 because of the predicted record low flows of the Columbia River, the removal of 6.9 million cu m of sediment from the Columbia River bar, and the need for data for model verification. The 1978 studies were for comparison purposes. Monthly neap tides produced the highest concentrations with the longest durations and furthest upstream intrusions of saline waters. The maximum intrusion of salinity at 2 ppt was 26.5 miles, and it exceeded 20 miles in all of the eight surveys. The highest salt concentration measured was 34.2 ppt at Tongue Point, a record level for the estuary. The concentration, extent and duration of salt water intrusion into the middle and upper Columbia River exceeded previous measurements, and salinities were higher on the south side of the channel rather than on the north. These changes may have effects on the distribution of benthic and pelagic fish and shellfish, with subsequent environmental and economic effects. Continued investigations are necessary to monitor any changes and predict their effects. (Brambley-SRC)
W82-02139

THE NUTRITIONAL SIGNIFICANCE OF THE DISTRIBUTION OF SUSPENDED PARTICULATE MATERIAL IN THE UPPER SAN-FRANCISCO BAY-ESTUARY,
California Univ., Davis. Dept. of Land, Air and Water Resources.
W. R. Barclay, and A. W. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 55-70. 2 Fig, 4 Tab, 37 Ref.

Descriptors: *Estuaries, *Suspended solids, *San Francisco Bay, California, *Nutrients, Salinity, Particulates, Carbohydrates, Proteins, Detritus, Zooplankton, Distribution.

A study was conducted to investigate the relationship between the distribution of nutritionally important suspended particulate matter and the area of the entrapment zone in upper San Francisco Bay estuary. The biochemical characteristics of the particulate material were measured monthly for a year at salinities of 0, 2, 4, 6, and 10 ppt. The particulate matter was size fractioned into two categories: 0.5 to 15 microns and 0.5 to 120 microns. Samples were analyzed for chlorophyl a, ATP, protein, carbohydrate, and particulate organic and inorganic carbon concentrations. At all salinities evaluated, an average of 78% of the protein and 75% of the carbohydrate was found in the 0.5 to 15 microns size fraction. From July through December the highest concentrations of suspended particulate matter were reported for the intermediate salinities of 4 and 6 ppt, indicating the presence of an entrapment zone at these salinities. The highest concentrations, of the biochemical components analyzed, occurred in the entrapment zone, except for carbohydrate and detrital carbon. The nutritional quality of the particulate matter, as measured by the protein/carbohydrate ratio, was higher in the entrapment zone than in adjacent upstream or downstream locations. The distribution of filter-feeding zooplankton over the same salinity range indicated rotifers and calanoid copepods were not significantly different between the salinities evaluated. Eurytemora hirundoides was the dominant adult copepod in the entrapment zone. The results indicate the entrapment zone is a nutritionally enhanced area for filter feeders in the estuary. Not all species studied appeared to be able to utilize this resource due to physiological requirements which restrict them to salinities higher or lower than the entrapment zone location. (Brambley-SRC)
W82-02140

EFFECTS OF FRESHWATER FLOW ON FISHERY RESOURCES IN THE SACRAMENTO-SAN JOAQUIN ESTUARY,
California State Dept. of Fish and Game, Stockton.
For primary bibliographic entry see Field 4C.
W82-02141

INFLUENCES OF FRESHWATER INFLOW ON CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA) IN THE SACRAMENTO-SAN JOAQUIN ESTUARY,
Fish and Wildlife Service, Stockton, CA.
For primary bibliographic entry see Field 6G.
W82-02142

SOME EFFECTS OF FRESH WATER ON THE ATCHAFALAYA BAY SYSTEM,
University of Southwestern Louisiana, Lafayette. Dept. of Botany.
For primary bibliographic entry see Field 6G.
W82-02143

ESTABLISHMENT OF CONTROLLED FRESHWATER DIVERSIONS OF THE MISSISSIPPI RIVER INTO THE LOUISIANA COASTAL ZONE,
Department of Natural Resources, Baton Rouge, LA.
For primary bibliographic entry see Field 4A.
W82-02145

FRESHWATER INFLOW TO ESTUARIES, SHORT AND LONG TERM PERSPECTIVES,
Delaware Univ., Newark. Dept. of Geology.
R. B. Biggs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 305-321. 2 Fig, 7 Tab, 16 Ref.

Descriptors: *Estuaries, *River flow, *Salinity, *Saline water intrusion, Oysters, Sea level, Land use, Water demand, Climates, *Chesapeake Bay, Freshwater inflow.

Evidence, from fauna buried beneath the upper Chesapeake Bay and from the presence of Crassostrea shell middens upstream from the low salinity limit of oysters, demonstrates that salinity in the estuary has been higher than it is at present. The salinity of the water was deduced from the presence and type of boring sponge holes. The age of the zone 1-2 m below the bottom was radiocarbon dated as 545 plus or minus 90 yr BP. Below this zone the sponge borings increase and then decrease. This is not consistent with a uniform rising sea level-rising estuarine salinity model. Changing land use in the upstream basins of both the Susquehanna and Delaware Rivers can be shown to produce significant modifications in peak and low freshwater discharges. The cause of the salinity excursion is not known, but changing land use, climate and competing demands for fresh water are suggested. (Brambley-SRC)
W82-02158

PRECIPITATION TRENDS AND VARIABILITY IN THE VICINITY OF NORTHWEST GULF COAST: 1900-1980,
Texas A and I Univ., Kingsville. Dept. of Geography and Geology.
J. Norwine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 322-334. 7 Fig, 7 Ref.

Descriptors: *Estuaries, *Estuarine environment, *Salinity, *Rainfall distribution, *Climates, Drought, Ecosystems, Climatic zones.

This study investigated the semiarid region of south Texas and northeastern Mexico to determine any detectable cycles or climatic periodicities, and whether they have been significant. Since there were no discernible trends in temperature, precipitation figures were studied. Both south Texas and northeastern Mexico showed precipitation trends. In south Texas there was a 25-year moist period starting in 1922, and a drought during the 1950's. In Mexico the years 1927-1945 were consistently moist, and there was a 20-year dry period starting in 1945, followed by a 10-year moist period. The rainfall in the Baffin Bay area was found to be variable and nonuniform in distribution. This results in the estuarine water being either hypersaline in dry conditions or hyposaline in wet conditions and in an extraordinarily dynamic complex estuarine ecosystem. (Brambley-SRC)
W82-02159

RAINFALL-RELATED TRENDS IN THE STRUCTURE OF A FISH-CRUSTACEAN COMMUNITY IN TEXAS' GALVESTON BAY SYSTEM,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
D. R. Johnson, K. Strawn, and W. H. Neill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 335-349. 7 Fig, 25 Ref.

Descriptors: *Estuarine environment, *Ecosystems, *Rainfall, *Fish, *Crustaceans, Salinity, Predation, Statistical models, Temperature, Fishkill.

Between 1972 and 1978, changes in fish and crustacean populations of Cedar Bayou Electric Generating Station's cooling lake on upper Galveston Bay seemed related to rainfall rates during winter and spring. Wetter years favored populations of young migratory fishes and crustaceans; larger, predatory fishes tended to be more abundant during dry years than during wet years. This pattern is consistent with the hypothesis that part of the upper bay's value as nursery grounds derives from their low salinities which repulse larger fishes, thereby protecting juvenile organisms from intense predation. Dynamics of the cooling-lake community responded also to variation in the power plant's T (the difference between upper discharge-canal and intake-area temperatures) and to the occurrence of infrequent fish kills. A trend model of system dynamics was formulated and tested for internal consistency. There was greater agreement among the biotic elements than for the model as a whole. Complexity is added by the selective filtering action of the steam-electric power plant through which all immigrants to the community must pass, and by the occurrence of fish kills. (Brambley-SRC)
W82-02160

EFFECTS OF UPLAND DRAINAGE ON ESTUARINE NURSERY AREAS OF PAMLICO SOUND, NORTH CAROLINA,
North Carolina Office of Coastal Management, Morehead City.
P. P. Pate, and R. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 402-418. 8 Fig, 1 Tab, 1 Ref.

Descriptors: *Estuarine environment, *Estuarine fisheries, *Shrimp, *Habitats, *Drainage ditches, *Rainfall, Salinity, Juvenile growth stage, Environmental effects, Aquatic productivity, Drainage effects, Ecological effects.

Four sampling stations were established in tributaries of northern Pamlico Sound, to measure the effects of upland drainage on primary nursery areas. The four stations received either heavy, moderate, or no drainage through man-made water courses. All stations functioned as primary nursery areas during periods of low rainfall and high salinity (1977). Brown shrimp production at all sites was depressed during periods of extremely high rainfall and low salinities (1978). Salinities at the unaltered sites were more stable during periods of high runoff than those recorded at two sites receiving drainage through ditches. Recovery times at the altered sites were approximately 10 days. The most significant reduction in production of juvenile brown shrimp occurred at the extensively ditched site during periods of moderate to heavy rainfall. There were no mass or complete movements of juvenile shrimp from the nursery areas as a response to rapid changes in salinity. The most serious effects of drainage into nursery areas appear to be the degree of alteration and the danger that alteration will be severe enough to create an unsuitable habitat during periods of normal rainfall. (Brambley-SRC)
W82-02164

A DYNAMIC METHODOLOGY FOR CHARACTERIZING AND MONITORING ESTUARINE ECOSYSTEMS,
Gulf Universities Research Consortium, Houston, TX.
For primary bibliographic entry see Field 7A.
W82-02167

A NUMERICAL SIMULATION OF THE VERTICAL AND HORIZONTAL M2 TIDE IN THE BRISTOL CHANNEL AND COMPARISONS WITH OBSERVED DATA,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles.
Limnology and Oceanography, Vol 26, No 3, p 571-577, May, 1981. 2 Fig, 27 Ref.

Descriptors: *Mathematical models, *Tidal currents, *Estuaries, Tidal rivers, Water currents, Tidal effects, Mathematical studies, *Bristol channel, *Severn Estuary, United Kingdom, Comparison studies.

Observed and modeled currents are compared for the M2 tide in the Bristol channel and Severn Estuary (United Kingdom). Currents were measured; data were analyzed in terms of the M2 tidal ellipses, and depth averaged values were estimated. A depth-averaged hydrodynamical numerical model was used to simulate the M2 tide. When computed and observed vertical M2 tides were compared, the amplitudes were accurate to within 4%. Computed and observed current ellipse phases were not significantly different. The computed tidal currents can be used to estimate the magnitude of the tidally averaged frictional stress at the seabed. Also, the rate of dissipation of tidal energy per unit mass of water column can measure the vertical mixing due to tidal flow. This can be used to parameterize the location of frontal regions separating thermally mixed and thermally stratified water masses during the summer. (Small-FRC)
W82-02193

SEASONAL VARIATION OF VITAMIN B12, B12 ANALOGS, AND PHYTOPLANKTON IN A LONG ISLAND ESTUARY,
New York Ocean Science Lab., Montauk.
S. F. Bruno, R. D. Staker, and L. L. Curtis.
Journal of Marine Research, Vol 39, No 2, p 335-352, May, 1981. 4 Fig, 5 Tab, 40 Ref.

Descriptors: *Seasonal variation, *Vitamins, *Phytoplankton, *Estuaries, Bioassay, Diatoms, Regression analysis, Peconic Bay, Vitamin B12, *Peconic Bay estuary, Long Island, New York.

The seasonal distribution of dissolved vitamin B12 and its analogs was determined in Peconic Bay estuary, Long Island, New York, and the significance of these cobalamins with respect to phytoplankton populations is discussed. Water samples were collected from nine stations from August 1976 to April 1978. Phytoplankton cell counts and identifications were made using a nanoplankton counting chamber, and concentrations of dissolved B12 and B12 analogs were determined by bioassay using the diatom Thalassiosira pseudonana Hasle et Heimdal, Clones 3H and 13-1. Regression analyses did not show any consistent correlation of phytoplankton population parameters with dissolved B12 or B12 analogs. Vitamin B12 is probably not important in limiting phytoplankton growth rates, and this explains the lack of correlation between B12 and phytoplankton parameters. There are possible autocthonous and allocthonous mechanisms for the introduction of cobalamins into the bay system. (Small-FRC)
W82-02282

ZOOPLANKTON SAMPLE VARIABILITY IN A TIDAL ESTUARY: AN INTERPRETATIVE MODEL,
Laval Univ., Quebec. Dept. of Biologie.
M. Gangnon, and G. Lacroix.
Limnology and Oceanography, Vol 26, No 3, p 401-413, 1981. 8 Fig, 2 Tab, 22 Ref.

Descriptors: *Tidal effects, *Zooplankton, *Estuaries, Mathematical models, Sampling, Tidal

rivers, Statistical analysis, *St. Lawrence River, Quebec.

The effects of tide-related advection processes on zooplankton sample variability were examined in a series of vertical hauls collected at a high sampling rate at an estuarine anchor station during part of a neap-to-spring tide cycle. A mathematical model was used to establish relations between the importance of short term temporal variability and the characteristics and displacements of the zooplankton field in the sampling area. Zooplankton was collected in the upper St. Lawrence River from July 2 to 12, 1975, once every 30 min to yield 347 samples. Data were analyzed using time series analysis, and sample variability was determined. Most of the variability was caused by periodic horizontal advection of zooplankton gradients. Thus, tidal effects on sampling must be considered when designing experiments. (Small-FRC)
W82-02306

THE EARLY DIAGENESIS OF ALIPHATIC HYDROCARBONS AND ORGANIC MATTER IN SEDIMENTARY PARTICULATES FROM DABOB BAY, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W82-02310

ON THE ADVECTION OF TURBIDITY IN THE SAINT LAWRENCE MIDDLE ESTUARY,
McGill Univ., Montreal (Quebec). Inst. of Oceanography.
B. D'Anglejan.
Estuaries, Vol 4, No 1, p 2-15, March, 1981. 13 Fig, 22 Ref.

Descriptors: *Estuaries, *Turbidity, *St. Lawrence Estuary, Suspended sediment, Sedimentation, Tidal currents, Particulate matter, Sediment transport, Advection.

Some physical characteristics of a middle estuary are discussed which influence the advective transport of the particulate suspended matter (PSM). The study area was the region of main turbidity gradient over the South Channel of the middle estuary in the St. Lawrence, between Quebec City and the Saguenay River entrance. The space and time distribution of the turbidity in this estuary appears to be largely determined by its channel physiography, fluctuations in the river discharges, and the tidal wave asymmetry. Three main regions are distinguishable within the broad turbid zone. The geometry of the South Channel consists of a succession of constrictions and widenings which modulate the flow velocity and creates considerable increases in the energy available for sediment transport in regions of constriction. A tidal phase difference across the estuary creates strong shears at the turn of the tide on the crest of the English Banks, facilitating erosion of the plume along its northern boundary and the cross-channel transport of suspended matter from the South into the North channel. Upstream of the main front, tidal fluctuations in the turbidity take place within the plume, with brief intense maxima near low water slack. They coincide with a considerable reduction in stratification, facilitating the upward dispersion of the turbidity from the bottom into the upper layer. The plume is reinforced by the introduction during the ebb of suspended material from inshore waters, and particularly from Sainte Anne Bay. This area provides an important local source of PSM to the plume and helps stabilize the main frontal zone. (Baker-FRC)
W82-02344

THE DYNAMICS OF CONSERVATIVE MIXING IN ESTUARIES,
New Hampshire Univ., Durham. Ocean Processes Analysis Lab.
T. C. Loder, and R. P. Reichard.
Estuaries, Vol 4, No 1, p 64-69, March, 1981. 4 Fig, 16 Ref.

Descriptors: *Estuaries, *Mixing, Dynamics, Mathematical studies, Model studies, *Saline water intrusion, Destratification, Salinity, Chemical composition, Estuarine environment, Flushing.

This paper demonstrates that salinity-constituent mixing curves, produced under conservative or non-reactive mixing conditions in an estuary, may not be linear due to temporal variation in end-member constituent concentrations. Thus the use of mixing curves for the interpretation of estuarine processes must be undertaken with an understanding of the river and ocean constituent variability and their relationship to the estuary's mixing properties and flushing time. A one-dimensional dispersion equation was used to calculate the distribution of salinity and a conservative constituent in a model estuary. Both straight and bent mixing curves are shown, resulting simply from changing the variability of the river constituent concentration. For no variability, the curve is straight. For variability with a period much less than the flushing time, the average curve for a general data set is straight, whereas the curve for a synoptic data set is bent. For variability with a period greater than the flushing time, a bent curve results. (Baker-FRC)
W82-02345

COMPOSITION AND VERTICAL FLUX OF ORGANIC MATTER IN A LARGE ALASKAN ESTUARY,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
A. J. Chester, and J. D. Larrance.
Estuaries, Vol 4, No 1, p 42-52, March, 1981. 5 Fig, 3 Tab, 28 Ref.

Descriptors: *Estuaries, *Organic matter, Sediments, Sedimentation, Bottom sediments, Carbon, Nitrogen, Benthos, Chlorophyll, Estuarine environment, Vertical distribution, Lower Cook Inlet, *Alaska.

The natural and vertical flux of organic particles as they contribute to the benthic food web of a large Alaskan estuary are examined. Sediment traps were used to sample organic detritus settling to the bottom of lower Cook Inlet. Composition and downward flux of this detritus were related to phytoplankton standing stock and primary productivity measured in the ambient water. It supports an extremely productive benthic community rich in commercially harvested populations of snow, king, and dungeness crabs, shrimp, razor clams, scallops and halibut. The most productive region was Kachemak Bay, which also experienced the largest downward flux of organic detritus. The greatest fluxes of fecal pellets, carbon, nitrogen, and plant pigments were measured there. The Bay is noted for abundant benthic populations and is a center for sport and commercial trawling activities. Chlorophyll and chlorophyll degradation products in the water column and sediment traps indicated that about 8.5% of the phytoplankton standing stock was sedimented to the bottom each day in Kamishak and Kachemak Bays. In the central inlet the average loss rate was lower and more variable. The chief mechanism for the downward transport of the material was traced to zooplankton grazing and subsequent fecal pellet production. An increase in carbon:nitrogen ratios from the water column to the sediments suggests that easily digested nutritive compounds are preferentially used as organic matter is transferred through the food web. (Baker-FRC)
W82-02347

SEWAGE OUTFALL LOCATION REDUCES ENVIRONMENTAL DAMAGE IN THE THAMES ESTUARY,
Metropolitan Pollution Control-Thames Water, London (England).
For primary bibliographic entry see Field 5G.
W82-02404

EFFECT OF PEMBROKE POWER STATION ON THE TEMPERATURES IN MILFORD HAVEN, WALES,
Central Electricity Generating Board, Bristol (England).
For primary bibliographic entry see Field 5C.
W82-02406

CADMIUM, COPPER, LEAD, ZINC AND MANGANESE IN THE POLYCHAETE ARENICOLA MARINA FROM SEDIMENTS AROUND THE COAST OF WALES,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W82-02416

SEASONAL VARIATION IN THE PREVALENCE OF 'RED SPOT' DISEASE IN ESTUARINE FISH WITH PARTICULAR REFERENCE TO THE SEA MULLET, MUGIL CEPHALUS L.,
Southern Fisheries Research Center, Deception Bay (Australia).
L. J. Rodgers, and J. B. Burke.
Journal of Fish Diseases, Vol 4, No 4, p 297-307, January, 1981. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Fish diseases, *Fish, *Estuaries, Seasonal variation, Diseases, Bacteria, *Australia, Temperatures, Mullet.

The Nossa River arises directly south of Tin Can Bay and flows through a largely undeveloped region to discharge into Laguna Bay, Australia. Two large shallow lakes, Lake Cootharaba and Lake Cooroibah, damp the flow of the river. Lake Cootharaba acts as a freshwater reservoir which prolongs the period of flood run-off. Sampling of fish was made at two sites, the first near the mouth of the Noosa River and the second at the northern end of Lake Cootharaba. The presence of lesions on the fish was taken as an indication of the occurrence of red spot disease. Infected fish usually displayed a single lesion on the flank or dorsal surface. Multiple lesions were observed upon individual fish. The occurrence of epizootics of vibriosis and other bacterial diseases has in other studies been linked with significant environmental changes. Such a period of significant change was induced by heavy rainfall and associated run-off during the early months of this study. The salinity of the river mouth was depressed to below 5 ppm at a time when low, declining temperatures were also present. Simultaneously, significant levels of infection were present during this period. These levels of infection contrast markedly with those low levels present at the river mouth during the period of November 1976 to February 1977 when relatively high, stable salinities (27 ppm) and temperatures prevailed. The study indicates the significance of factors such as temperature fluctuations, salinity, host movement, spawning and schooling behavior in epizootic occurrences. (Baker-FRC)
W82-02426

GROWTH OF MYTILUS EDULIS IN NET BAGS TRANSFERRED TO DIFFERENT LOCALITIES IN A EUTROPHICATED DANISH FJORD,
Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
For primary bibliographic entry see Field 5C.
W82-02428

DISCUSSION OF TRACE METALS IN THE WATERS OF A PARTIALLY-MIXED ESTUARY,
Washington Univ., Seattle. Dept. of Oceanography.
M. Rattray, Jr., and C. B. Officer.
Estuarine, Coastal and Shelf Science, Vol 12, No 3, p 251-266, March, 1981. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Estuaries, *Trace metals, *Path of pollutants, Metals, Model studies, *San Fracisco Bay, Bays, Mixing, Advection, Fluctuations, Tidal currents, Salinity.

A generalization is presented of methods commonly used for calculating the estuarine loss (or gain) of a constituent based on the relationship of its distribution to that of salinity. Included in the formulation are the effects of arbitrary cross-sectional shape, tidal drift, gravitational circulation and longitudinal tidal diffusion. Its application depends upon obtaining the sectional distributions of the constituent and of the salinity at two adjacent cross-sections, estimating the magnitude and con-

stituent concentration of the river inputs, and the tide and tidal current data for the region under study. Three cross-sections of the numerical simulation model of San Francisco Bay were used to carry out the calculations and test the results. The results compared favorably wth results from direct flux calculations using the accompanying mean current information. A considerable range in the governing parameters was spanned by these three sections, thus providing good insight into the general applicability of the new formulation. An unusually good data set is provided by these examples. By reducing their spatial coverage it becomes apparent that large errors can possibly occur in the calculated loss rate when the data coverage is less ideal. When the net flux through a section is relatively large compared to the loss rate, this problem is particularly severe. It is at this point nearly in balance with the river supply. When applying this formulation it is suggested that the sensitivity of the final results be assessed as to the accuracy with which the relevant constituent and salinity fields are known. (Baker-FRC)
W82-02542

VARIATION IN LIFE-HISTORY PATTERNS BETWEEN INTERTIDAL AND SUBTIDAL POPULATIONS OF THE MEIOBENTHIC COPEPOD MICROARTHRIDION LITTORALE,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
M. A. Palmer.
Marine Biology, Vol 60, No 2/3, p 159-163, 1980. 6 fig, 1 Tab, 35 Ref.

Descriptors: *Benthic fauna, *Population density, *South Carolina, *Copepods, Microarthridion littorale, Estuarines, *Estuarine environment, Tides, Intertidal areas, Meiofauna.

Reproductive patterns of intertidal and subtidal populaticns of Microarthridion littorale were compared to ascertain the significance of the following parameters: population density and age structure, adult size, timing of reproduction, number of eggs per gravid female and number of eggs per adult female, and birth and death rates. Densities of M. littorale were significantly greater intertidally during the summer and fall. For the remaining seasons, the population densities did not significantly differ between intertidal and subtidal groups. Intertidal maximum densities occurred in July, whereas maximum densities subtidally were in October. Far greater numbers of eggs per gravid female were recorded in the subtidal populations at all times. Birth and death rates paralleled each other but were high subtidally with the exception of August. It is suggested that these differences resulted from differences in food quality and quantity, increased exposure to potential epibenthic predators subtidally, and exposure to differential competitive pressure in the two areas. (Baker-FRC)
W82-02560

LARGE VERTICAL SALINITY GRADIENTS IN THE FT. PIERCE INLET ASSOCIATED WITH HURRICANE DAVID,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
G. H. Kierspe.
Florida Scientist, Vol 44, No 2, p 104-109, 1981. 4 Fig, 5 Ref.

Descriptors: *Hurricanes, *Estuarine environment, Storms, Salinity, Environment, Coasts, Estuaries, Floods, *Fort Pierce Inlet, *Florida, Saline water intrusion.

The effects of Hurricane David on the vertical salinity gradient in an ordinarily well-mixed inlet are reported. Salinity was measured at different depths in the inlet about 1 wk before and after the passage of the storm, on September 3, 1979. Associated with the hurricane were 22.7 cm of rain and maximum winds of 153 km/hr. The water level at the Ft. Pierce Inlet was about 95 cm above the mean water level recorded prior to the passage of the hurricane. The major freshwater influence on the Inlet is from Taylor Creek, a drainage canal regulated by a series of locks. Vertical mixing is evident in the Inlet by large eddies and upwelling areas caused by bottom irregularities. The pre-storm sampling showed the water column to be well mixed. At the end of the ebb, the surface salinity was 34.5 ppt and the bottom was 35.2 ppt, a difference of only 0.7 ppt. After the hurricane, the surface-to-bottom salinity gradient was large during all of the ebb, and the first part of the flood. At slack water after the flood, the water column was homogeneous with a salinity of 34.6 ppt. During the ebb the bottom salinity dropped to 31.0 ppt and the surface salinity reached a minimum of 19.1 ppt, a difference of 11.0 ppt. After the flood tide began, the surface and bottom salinities climbed rapidly to 34.6 ppt. The water column was again homogeneous about 2 hr into the flood tide. The significance of this study is great when one considers the general lack of information on post-hurricane effects for an estuarine location. (Baker-FRC)
W82-02569

VERTICAL MIXING RATES IN FJORDS DETERMINED USING RADON AND SALINITY AS TRACERS,
Lamont-Doherty Geological Observatory, Palisades, NY.
W. M. Smethie, Jr.
Estuarine, Coastal and Shelf Science, Vol 12, No 2, p 131-153, 1981. 10 Fig, 4 Tab, 39 Ref.

Descriptors: *Fjords, *Salinity, *Radon, *Mixing, Tidal energy, Tidal effects, Tracers, Tidal hydraulics, Runoff, Saline-freshwater interfaces, Coastal waters, Washington, British Columbia.

The excess radon-222 profiles of several Washington State and British Columbia fjords were measured in attempts to understand the vertical mixing processes of these embayments. During periods of bottom water stagnation, exponential profiles were generally observed. Salinity changes and exponential excess radon profiles of the stagnant bottom water were utilized to calculate values of the vertical eddy diffusivity. Variations in these values which ranged from 0.16 to 36 sq cm/sec among fjords were attributed to different inputs of tidal energy into the vertical mixing process. Excess radon due to freshwater runoff was also found in the surface water of some fjords. For Narrows Inlet, values of the vertical eddy diffusivity were 0.23 to 0.47 sq cm/sec in the surface waters and 0.9 to 3.1 sq cm/sec between 5 and 35 m depth. (Geiger-FRC)
W82-02576

BENTHIC ENRICHMENT IN THE GEORGIA BIGHT RELATED TO GULF STREAM INTRUSIONS AND ESTUARINE OUTWELLING,
Skidaway Inst. of Oceanography, Savannah, GA.
R. B. Hanson, K. R. Tenore, S. Bishop, C. Chamberlain, and M. M. Pamatmat.
Journal of Marine Research, Vol 39, No 3, p 417-441, August, 1981. 1 Fig, 11 Tab, 73 Ref.

Descriptors: *Benthic fauna, *Nutrients, *Distribution patterns, Gulf Stream, *Georgia Bight, Florida, Ocean currents, Estuaries, Particulate matter, Continental shelf, Biomass, Rivers, Organic matter, Deposition, *Coastal waters.

The distribution patterns of benthic life in the Georgia Bight, sampled at 12 sites between the Savannah River, Georgia, and Daytona Beach, Florida, indicated that constant intrusions of nutrient-rich Gulf Stream water at the shelf break are important to the offshore benthic communities. Estuaries, often considered as major nutrient sources to outer continental shelf systems, are probably not effective beyond 20 km off the Georgia coast. Although the presence of Spartina marshes and a large number of major rivers in Georgia would be expected to enrich benthic life off the coast to a greater degree than off the Florida coast, this is not the case. Possible explanations are the low nitrogen content of detritus and the restriction of offshore transport of nutrients by salinity fronts and alongshore currents. Microbiota were 2-3 times more numerous at the shelf break than at the mid shelf and inner shelf and increased southward along the shelf break. Densities were highest in areas of frequent intrusions. (Cassar-FRC)
W82-02583

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING DEMONSTRATION PLANT FEASIBILITY STUDY AT LAGUNA PUEBLO, NEW MEXICO.
MetaMetrics Inc., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153362, Price codes: A07 in paper copy, A01 in microfiche. Technical Report submitted to Office of Water Research and Technology, March 31, 1981. 124 p, 19 Fig, 39 Tab, 98 Ref. OWRT-C-00255-D(0452)(1), 14-34-0001-0452.

Descriptors: Feasibility study, *Desalination, Desalination plant, *Water supply development, Water quality, Water rights, Water use, Capital costs, Operating costs, Maintenance costs, Project benefits, Regional development, *Cost-benefit analysis, *Laguna Pueblo, Indian reservation, Laguna, *New Mexico, Canoncito, *Groundwater availability.

Water of drinking quality is scarce on the Laguna Reservation, located 20 miles west of Albuquerque, New Mexico. The feasibility of developing a demonstration desalting plant to provide for the water requirements of 2,000 members of the Laguna Pueblo included a review of the existing water resources. Four desalting and three non-desalting alternatives were evaluated. The study included legal, political and socio-economic factors important to developing water supplies in the water scarce environment. Of the brackish water sources, the Rio Puerco was the lowest cost alternative. The fresh water alternatives could provide water at $1.93 per 1,000 gallons of water as compared to $4.01 per 1,000 gallons for desalting. The development of the Rio Grande fresh water aquifer would require the purchase of water rights and the City of Albuquerque could oppose such action.
W82-02104

OPERATING CHARACTERISTICS OF VARIOUS COMBINATIONS OF WORKING SUBSTANCES AND FEEDS IN THE SCHROEDER DESALTING PROCESS.
Schroeder Process Corp., Santa Ana, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153560, Price codes: A06 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, 1981. 123 p, 21 Fig, 4 Ref, 2 Append. OWRT-C-00135-S(0450)(1), 14-34-001-0450.

Descriptors: *Distillation processes, *Vapor compression evaporation, *Vertical tube evaporation, *Freeze process, Waste disposal, Research results, Bench scale, Energy costs, Fixed costs, Water costs estimate, *Desalination, *Desalination apparatus.

A novel process has been discovered which has the potential to combine the advantages of both distillation and freezing processes, without the disadvantages. The process uses a working substance (WS), such as a high melting organic compound, at its freezing point, to effect direct contact evaporation. The purpose of this project was to investigate the operating characteristics of various WSs in the laboratory and a bench scale plant (BSP). A WS screening program tested melting range, solubility, tendency to entrain or emulsify, and stability, in the laboratory program. The BSP program satisfactorily simulated the operation of major pieces of equipment, using WSs that passed the screening program with seawater, and other saline water

feeds. The process is ready for pilot plant design, construction, and operation.
W82-02105

NON-ACID PRETREATMENT AND MANAGEMENT OF MICROORGANISMS IN SEAWATER DESALINATION BY REVERSE OSMOSIS,
Permutit Co., Inc., Paramus, NJ.
A. B. Mindler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153396, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, November, 1981. 91 p, 9 Fig, 3 Tab, 5 Ref. OWRT-C-00093-D(0466)(1), 14-34-0001-0466.

Descriptors: *Desalination, *Reverse osmosis, *Seawater, *Scale prevention, *Fouling, *Microorganisms, *Pretreatment of water, Bacteria, Algae, Protozoa, Diatoms, Chlorination, Tannins.

Non-acid pretreatment was studied in a seawater reverse osmosis pilot plant for one year with particular attention to biological aspects. Pretreatment of the tropical surface seawater by in-line coagulation/filtration reduced the Silt Density Index (SDI) consistently below 3.0 in the polishing filter effluent. Subsequent biological activity of periphytic organisms on piping surfaces after addition of organic antiscalants increased SDI by one unit or more. Slough-off of the organisms' polysaccharide sheaths resulted in fouling of the hollow fiber permeators. A 2000 hour run was made with 3 ppm polyacrylate antiscalant at ambient pH of 7.9 on one RO system in parallel with another system at pH 7.5, reduced by addition of 15 ppm sodium bisulfite. A 3000 hour run was made with Quebracho tannin as combined antiscalant/antifoulant under similar conditions. For the last 1500 hours tannin was employed in place of starvation chlorination for intake protection. Both polyacrylate and tannin antiscalants were found to serve as nutrient for bacterial growth, and both impaired RO performance. Tannin uniquely decreased the attachment ability of periphytic bacteria. No hard scale was found during autopsy, but a small amount of amorphous calcium salt was detected in potted fiber ends of the permeators and in piggy-back spiral wound elements. Analyses of foulants are reported.
W82-02108

DEVELOPMENT OF HIGH SALT REJECTION REVERSE OSMOSIS MEMBRANES--FINAL REPORT, JULY 1, 1978 THROUGH DECEMBER 31, 1980,
UOP, Inc., San Diego, CA. Fluid Systems Div.
C. E. Milstead, and R. L. Riley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153370, Price codes: A05 in paper copy, A01 in microfiche. January, 1981. 74 p, 17 Fig, 20 Tab. OWRT-C-00163-D(7529)(1), 14-34-0001-7529.

Descriptors: Composite membranes, *Reverse osmosis, Brackish water, *Desalination, *Spiral-wound elements, *Membrane processes, *Roswell, New Mexico, *Yuma, Arizona.

The objective of this three-phase program was to develop a high-salt rejection thin-film composite membrane for incorporation into 8- and 12-in. diam. x 40-in. wide spiral-wound elements suitable for replacement elements for the 75 MGD Yuma Desalting Plant. Four types of thin-film composite membranes, prepared by interfacial polycondensation techniques on a fabric-reinforced porous polysulfone support, were evaluated. The optimum membrane, a polyamide, designated TFC-402, was successfully produced in large quantities for spiral-wound element fabrication. This membrane, yielding 22-25 gal/ft2-day and greater than 99% TDS rejection from a Yuma Plant 70% recovery brine at 400 psi applied pressure, was fabricated into 2 1/2-, 4-, 8-, and 12-in. diam. x 40 in. wide elements for field testing at the OWRT Test Facility at Roswell, N.M. Testing of the 8- and 12-in. elements, prior to shipment to Roswell, in San Diego on a 4500 ppm TDS brackish well water feed showed that both element types gave about 99% rejections with high product fluxes.
W82-02109

DRAFT ENVIRONMENTAL ASSESSMENT DESALTING DEMONSTRATION PLANT, LAGUNA, NEW MEXICO.
MetaMetrics Inc., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153735, Price codes: A05 in paper copy, A01 in microfiche. Technical Report submitted to Office of Water Research and Technology, March 31, 1981. 72 p, 8 Fig, 12 Tab, 98 Ref. OWRT-C-00255-D(0452)(2), 14-34-0001-0452.

Descriptors: *Desalination, *Environmental effects, Environmental impact statement, *Wastewater lagoons, Wastewater disposal, Desalination wastes, Ecological effects, Land use, Air pollution, Noise, Feasibility study, *Water supply development, *Laguna Pueblo, Indian Reservation, Laguna, *New Mexico, Canoncito.

The environmental consequences of the construction and operation of a desalting demonstration plant were assessed. A desalting demonstration plant using brackish well water could supply a Laguna community which had been proposed for the site and the nearby Canoncito Navajo Reservation with potable water. A well field located at the plant site would withdraw approximately 400,000 gallons per day to produce 300,000 gallons per day of potable water. Yields of individual wells were estimated to be 50 gpm and as many as six wells would be required. Transmission of water from the well field to the plant site would require 1,000 feet of pipeline. The major waste products which will result from the operation of the desalting plant are a high TDS brine and sludges. Evaporation ponds would dispose of the brine. A design was specified to present leakage from the ponds. Multi-cell, sludge drying beds were specified for disposal of sludge. The environmental effects and impacts of construction and start-up of the plant were assessed along with those of the proposed new community.
W82-02171

POST-TREATMENT PROCESS FOR REVERSE OSMOSIS MEMBRANES,
FilmTec Corp., Minneapolis, MN.
J. E. Cadotte, R. S. King, R. J. Majerles, C. Hultman, and R. J. Petersen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157975, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, January, 1981. 35 p, 2 Fig, 10 Tab, Append. OWRT-C-90090-S(9415)(1), 14-34-0001-9415.

Descriptors: *Colloids, *Sealants, *Desalination, *Reverse osmosis, *Membranes, Thin films.

Reverse osmosis membranes capable of producing potable water from seawater by single-pass desalination processes are difficult to make. Small defects in the thin film barrier layer are introduced during various stages of production of desalination devices. This report covers research on synthetic and natural organic colloidal preparations that seal membrane defects. Types of colloids synthesized and tested included: polyamine-aldehyde,melamine-aldehyde, and polyphenol-aldehyde condensation products; piperazine-epoxy adducts; sulfonated polysulfone; oxidized polyamines, and crosslinked polyacrylic acid. Tannic acid was also tested for comparison. Colloidal preparations with 0.1-0.2 micrometers in thin film composite membranes. Spiral-wound membrane elements with as low as 93 percent salt rejection were improved to single-pass desalination quality by treatment with selected colloids. Sequential treatment with a cationic colloid, then an anionic colloid, produced some dramatically increased salt rejections in spiral elements initially showing only 68-85 percent salt rejection.
W82-02454

3B. Water Yield Improvement

AN INITIAL APPLICATION OF POLARIZATION LIDAR FOR OROGRAPHIC CLOUD SEEDING OPERATIONS,
Utah Univ., Salt Lake City. Dept. of Meteorology.
For primary bibliographic entry see Field 7B.
W82-02217

MANAGEMENT OF BLOWING SNOW ON SAGEBRUSH RANGELANDS,
Rocky Mountain Forest and Range Experimental Station, Laramie, WY.
D. L. Sturges, and R. D. Tabler.
Journal of Soil and Water Conservation, Vol 36, No 5, p 287-292, September-October, 1981. 7 Fig, 3 Tab, 15 Ref.

Descriptors: *Snow management, *Range management, Water resources, Range grasses, Vegetation, Fences, Snow storage, Snowmelt, Snow accumulation, Water supply, Snow traps.

Snow management on rangelands can increase forage production, make more water available for livestock and irrigation, and improve wildlife habitat. A procedure for estimating the volume of blowing snow arriving at specific locations is especially important for successful snow management. Two equations are offered which make it possible to design successful snow management projects. Measured snow storage was in reasonable agreement with predicted transport at both a snow fence and snow harvest areas where these predictions were tested. At the Dodge Creek Ranch 54 cubic meters per meter (581 cubic feet/foot) of additional water stored by snow fencing represented 'new' water for the rancher, since most of it would otherwise have evaporated as it was transported across the watershed. At Boundary ridge, a snow harvest area was created by chopping sagebrush on the windward side of a ridge, providing 24 cubic meters per meter (258 cubic feet/foot) of additional water equivalent in the leeward drift. However, little water reached the stock water pond it was intended to recharge. This result underlines the importance of incorporating water collection and conveyance facilities into snow management projects. Water losses to evaporation, soil recharge, and deep seepage usually comprise a large percentage of water stored in large drifts. Increasing the roughness height of vegetation by planting crested wheatgrass in strips doubled on-site snow retention compared with that retained on untreated sagebrush rangeland. Increasing the retention of snow should increase soil water recharge and improve site productivity. (Baker-FRC)
W82-02247

3C. Use Of Water Of Impaired Quality

LEGAL, ECONOMIC AND INSTITUTIONAL BARRIERS TO WATER REUSE IN NORTHERN NEW ENGLAND, BOSTON, MASSACHUSETTS,
Bracken and Baram, Boston, MA.
M. S. Baram.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153388, Price codes: A08 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-81/6, September, 1980. 150 p, 2 Fig, 1 Tab. OWRT-C-90186-R(9424)(1), 14-34-0001-9424.

Descriptors: *Water reuse, *Legal aspects, *Institutional constraints, *Common law, *Public investment, *Effluent limitations, Water supply, Water conservation, Taxes, Economic aspects, Navigable waters, Groundwater, Surface water, Financing, Industrial water, Agriculture, Recycling, Water quality, *New England, Maine, New Hampshire, Massachusetts, Vermont.

Legal and institutional reforms at federal, state and local levels of government are needed to remove major obstructions to water reuse as a conservation strategy in northern New England. Legal

research and seven case studies on municipal, industrial, energy and agricultural users of water in Massachusetts, New Hampshire, Maine and Vermont reveal that the obstructions to water reuse call for immediate legal reforms in four areas: (1) availability of public funds under federal construction grant program for wastewater treatment; (2) use of environmental controls on current practices to force adoption of reuse technology; (3) modification of property rights in water doctrines of the common law; and (4) modification of water rates and rate structures now in use. Further, institutional reforms are needed. The networking of fragmented authorities is needed to promote coherent regional strategies for conservation and reuse. Thus, future water management in northern New England could begin to cope with growing water shortages by adopting conservation principles and reuse practices.
W82-02107

ECONOMIC AND TECHNICAL EVALUATIONS OF SWINE MANURE MANAGEMENT SYSTEMS WHICH USE LAND APPLICATIONS,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
For primary bibliographic entry see Field 5E.
W82-02175

EFFECTS OF SCHEDULING MUNICIPAL WASTE-WATER EFFLUENT IRRIGATION OF REED CANARYGRASS ON NITROGEN RENOVATION AND GRASS PRODUCTION,
Minnesota Univ., St. Paul. Dept. of Soil Science.
D. R. Linden, C. E. Clapp, and J. R. Gilley.
Journal of Environmental Quality, Vol 10, No 4, p 507-510, October/December, 1981. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Wastewater irrigation, *Irrigation water, *Grasses, *Nitrogen removal, Wastewater disposal, Reed canarygrass, Soil water, Effluents, Water pollution effects, Fate of pollutants, Reclaimed water, *Impaired water use, Municipal wastewater.

Municipal wastewater applied to a 12 x 12 meter field of reed canarygrass (Phalaria arundinacea L.) produced yields of 10.2 and 15.0 metric tons per ha during 1975 and 1976, respectively. Effluent was obtained from the Apple Valley Wastewater Treatment Plant, Minneapolis-St. Paul, Minnesota, an activated sludge treatment facility serving a domestic suburban population. Soil was a Waukegan silt loam with a water table at 140 cm. The first year total application was 170 cm of effluent containing 320 kg per ha N, primarily as ammonium. The second year total application was 290 cm containing 530 kg per ha N. Varying the sprinkler irrigation schedules (1,2, or 5 irrigations per week) did not affect yields. Effluent contained 17-18 mg per liter N. Soil water concentrations averaged 1.0 and 2.4 mg per liter in 1975 and 1976, respectively. Crop uptake of N was abourt 80%. It is expected that the long-term soil water N levels would not increase much beyond the level measured in the second year. (Cassar-FRC)
W82-02219

VIRAL TRANSPORT TO GROUND WATER AT A WASTEWATER LAND APPLICATION SITE,
Texas Univ. at San Antonio.
B. E. Moore, B. P. Sagik, and C. A. Sorber.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1492-1502, October, 1981. 1 Fig, 9 Tab, 13 Ref.

Descriptors: *Water reuse, *Wastewater irrigation, *Path of pollutants, *Viruses, Water pollution sources, Fate of pollutants, Wastewater disposal, Irrigation water, Irrigation wells, Coliforms, Enteroviruses, Percolation, Bacteriophage, Texas.

The survival and transport of human enteric viruses through soil at an operating waste water irrigation site at Kerrville in South Central Texas were studied. Water sampling was carried out at three specially designed lysimeter sites and five monitoring wells. Bacterial and physical/chemical analyses as well as studies on the effects of more intensive irrigation were also carried out. In general, bacteria and coliphage densities were highest in the water collected at Lysimeter 1, which was closest to the irrigation pond. Although enteric virus isolations were made from each site, the most frequent recoveries occurred at Lysimeter 2 at an average depth of 1.37 m. Fecal coliforms and fecal streptococci were found with relatively high frequency at all monitoring wells, while no positive virus isolations from well water samples were made. Results of the intensive irrigation program showed that fecal coliforms and fecal streptococci were generally reduced by more than 90% in lysimeter waters within the 0.46 m depth. The isolation of enteroviruses in water from lysimeters, but not from monitoring wells, suggests that depth to ground water should be an important consideration in selecting irrigation sites. (Geiger-FRC)
W82-02317

REDUCING GROUND-WATER POLLUTION FROM MUNICIPAL WASTE-WATER IRRIGATION OF RHODES GRASS GROWN ON SAND DUNES,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).
I. Vaisman, J. Shalhevet, T. Kipnis, and A. Feigin.
Journal of Environmental Quality, Vol 10, No 4, p 434-439, October/December, 1981. 9 Fig, 2 Tab, 9 Ref.

Descriptors: *Wastewater irrigation, *Irrigation water, *Nutrient removal, Nitrogen, Phosphorus, Fertilizers, Rhodes grass, Grasses, Water pollution control, Fate of pollutants, Wastewater treatment, Secondary wastewater treatment, Wastewater disposal, Impaired water use.

Application of secondary municipal effluent from settling ponds to sandy dune soil established with Rhodes grass (Chloris gayana Kunth) produced a high yield of animal feed without polluting groundwater with nitrate and P. The irrigation experiments were carried out during 1978 and 1979 in Israel. There were 4 treatments, 60, 80, 100, and 120% of Class A pan evaporation, using 5510, 6540, 8190, and 9580 cu m per ha of water, respectively. Fertilizers applied were either 0 or 700 kg N in 1978 and 250 or 500 kg N in 1979. Maximum yield of grass (12.2 Mg per has) was attained at the 80% irrigation treatment with 250 kg N fertilization. Higher quantities of water or fertilizer did not improve yields further. P in lysimeter drainage water did not exceed 0.5 mg per liter. Ammonium-N was not detected; nitrates were 0.5 mg per liter in drainage from the 250 kg-fertilized plot and 3-150 from the 500 kg fertilized plot. BOD was reduced from 53-72 mg per liter in the effluent to 3.2 mg per liter in the drainage water. Some salt leaching occurred, but winter rains removed most of the excess salts left in the soil after the irrigation season. (Cassar-FRC)
W82-02391

ACCUMULATION OF HEAVY METALS IN ARID-ZONE SOILS IRRIGATED WITH TREATED SEWAGE EFFLUENTS AND THEIR UPTAKE BY RHODES GRASS,
Hebrew Univ., Rehovot (Israel). Dept. of Soil and Water Sciences.
For primary bibliographic entry see Field 5B.
W82-02392

EFFECT OF SALINE IRRIGATION WATER ON THE YIELD OF POTATO,
Indian Agricultural Research Inst., New Delhi.
K. V. Paliwal, and B. R. Yadav.
Indian Journal of Agricultural Sciences, Vol 50, No 1, p 31-33, January, 1980. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Crop yields, *Irrigation practices, Salinity, Chemical properties, *Saline water, *Potatoes, *Impaired water use.

A study was conducted to determine the effect on yield, size, and number of potato tubers and the development of soil salinity in the root zone when saline water is used for irrigation. In both years of the study the yield of potato showed an abrupt, significant decrease with the application of saline water even of a salt concentration of 20 meq/liter. However, the significance of this reduction was not increased at 40 meq/liter concentrations. At a salinity of 80 meq/liter the yield was reduced by about 45% of that of the control. The effect of salinity on the total tuber number was significant at all salinity levels in the first year. In the second year, however, it was significant only at a salinity of 40 meq/liter and above. This minor variation was primarily due to the fact that canal water used as a control in the first year was of slightly better quality than the tubewell water used in the second year for control crops. Saline water irrigation significantly reduced the yield of tubers of all sizes, and reduced the sizes as well. In general the percentage reduction was due more to decrease in total yield and tuber size than in tuber number, particularly at the highest salinity level. (Baker-FRC)
W82-02398

COMMUNITY EVALUATION OF ADOPTED USES OF RECLAIMED WATER,
California Univ., Berkeley. School of Public Health.
W. H. Bruvold.
Water Resources Research, Vol 17, No 3, p 487-490, June, 1981. 3 Tab, 11 Ref. (California Water Resources Center Project UCAL-WRC-W-563).

Descriptors: *Water reuse, *Attitudes, *Reclaimed water, Surveys, Social aspects, Irrigation, Planning, Irvine, *California.

Irvine, California, currently uses reclaimed water for an ornamental lake, for golf course irrigation, for agricultural irrigation, for park and playground irrigation, and for common residential lawn irrigation. A survey of 140 residents determined that 75% were aware of the use of reclaimed water in the city, but about 50% were not familiar with details such as type of treatment, environmental changes, health risks, and costs. About 93% of the people had a favorable response to golf course, commons area, and park and school year irrigation; 88.6% for the ornamental lake; and 75.7% for food crop irrigation. Only 27.9% favored hypothetical use as drinking water. Recommendations for future local use were: add new uses, 24.3% in favor; expand existing uses, 5% in favor; maintain existing uses, 56.4%; and eliminate existing uses, 5%. Results were similar to those in a 1972 survey of attitudes toward possible future uses of reclaimed water in 10 California cities. (Cassar-FRC)
W82-02551

3D. Conservation In Domestic and Municipal Use

A FIELD EVALUATION OF SELECTED WATER CONSERVATION AND WASTEWATER REDUCTION SYSTEMS FOR RESIDENTIAL APPLICATIONS,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
R. L. Siegrist, W. C. Boyle, and D. L. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153651, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Report WIS WRC 81-02, 1981. 119 p, 23 Fig, 67 Tab, 36 Ref, 4 Append. OWRT-B-105-WISC(1), 14-34-0001-1153.

Descriptors: Potable water, *Reclaimed water, Recycling, Wash water, Wastewater, *Wastewater irrigation, *Water conservation, Water treatment.

In-house water-using activities in residential dwellings throughout the United States contribute to a yearly per capita consumption of potable water that exceeds 18,000 gallons. Numerous strategies have been proposed for reducing domestic water demands and wastewater loadings. A demonstration study was performed at the University of Wisconsin-Madison to evaluate the performance of several technologies under field conditions. The technologies offer the potential for major reductions in residential water demands and wasteflows.

The project was accomplished in three distinct phases. Commercial low-flush toilet systems were studied in Phase I. Inhouse water use and wasteflow characteristics were measured on a daily and hourly basis and water use impacts of the low-flush systems were assessed. Single-home washwater recycle systems were investigated in Phase II. Inhouse water use and wasteflow were characterized and the water use impacts of the recycle systems were assessed. The final phase of the project investigated the reclamation of residential greywater (non-toilet water) by conventional onsite treatment processes--a septic tank--sand filter system. Characterization of the raw greywater flow and the effluent from the septic tank and intermittent sand filter was accomplished.
W82-02180

WATER CONSERVATION PROGRAM OF THE CITY OF GREENSBORO,
Greensboro Public Works Dept., NC. Water and Sewer Administration.
R. Shaw.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 64-67. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Water conservation, *Water supply, *Water use, Leakage, *Water loss, Conservation, Public opinion, Attitudes, Water treatment, Water purification, Water shortage, Plumbing, Public policy, Long-term planning, *Greensboro, North Carolina.

There are three major requirements in the 'Resolution of Assurance to Continue Water Conservation Program of the City of Greensboro,' adopted in 1979: that the water loss prevention program will continue to operate, that the City will continue to enforce the State Plumbing Code, and that the City will continue its Program of Water Conservation Education. Education has emphasized pamphlets on policies for new customers, and meter-reading. The continuous leak-control program is costly but reduces water loss. Leak detection is done in part using the Heath-Sonic kit, with the goal of detecting 150,000 to 200,000 gallons per day of leakage during the year. Water accountability is a major part of the program: the goal is to sell 85 percent of the available water, while achieving accurate and adequate metering of water leaving the treatment plant. Inaccuracies exist because of leakage, underregistration of small meters, unmetered flushing of hydrants to clear impurities, and water used in fire emergencies. Every service in Greensboro, totaling 50,000, is metered. A meter-maintenance plan replaces old meters to improve accountability. Additions to the State Plumbing Cod adopted by the City in 1954 now include provisions regarding the capacity of commodes and showerheads. A closed washwater-recycle system at the treatment plant saves pumping costs for 125 million gallons a year. (Garrison-Omniplan)
W82-02518

WATER SAVINGS IN THE ORANGE WATER AND SEWER AUTHORITY,
Orange Water and Sewer Authority, Carrboro, NC.
E. Billingsley.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 68-73. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Water conservation, Long-term planning, *Water supply, *Cost-sharing, Aquifers, Water deficit, Water use, Public policy, Economic aspects, Jurisdiction, Public opinion, Local governments, *Water metering, *Hillsborough, North Carolina.

To augment a marginal supply of water, the Organge Water and Sewer Authority (OWASA) developed the Cane Creek Reservoir, constructed a 10-mile tie line to connect with the Town of Hillsborough, and acquired an abandoned stone quarry to provide 200 million gallons of additional raw water storage. More importantly, structural and nonstructural conservation measures were instituted. Among the structural conservation measures were: storage of filter washwater and sedimentation basin wastewater at the Water Filter Plant and recycling the supernatant back to the head of the treatment process; emphasizing leak detection and repair to reduce losses; ensuring accurate and reliable metering; and requiring low-flow showerheads and water-saving toilets on new construction. Nonstructural conservation methods emphasized rates, consumer education, and awareness. A rate structure was adopted with a monthly service charge based on the size of the meter and a uniform commodity charge of $1 per thousand gallons used. Consumer education has been facilitated by use of the media, bill inserts, brochures, speakers' bureaus, plant tours, newsletters, information presentations on such topics as how to read a meter, and restaurant table cards explaining water conservation in the restaurant. Five progressively more stringent stages of mandatory conservation were enacted by city ordinance, with their use dependent on level of water supply. Constant community awareness of the current state of the water supply has also been considered important. As a result of all these measures, water demand is at the same level as it was five years ago, even with normal community growth. (Mantius-Omniplan)
W82-02519

LEAK DETECTION - TWO METHODS THAT WORK,
G. B. Cole.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance. 1980. p 78-83, 5 Ref. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Water loss, *Leakage, *Flow measurement, Federal jurisdiction, *Measuring instruments, *Sound waves, Economic aspects, Grants, Water metering, Water shortage, Flowmeters, Gages, Flow profiles, Water conservation, Pipelines, Water supply systems, Maintenance.

The major activity in reducing the amount of unaccounted-for water in utilities is the detection, location and repair of hidden underground leakage. This has been assigned a high priority by many utilities. Recognizing the need for developing and disseminating information on leak detection, AWWA formed a Leak Detection Committee to help educate operators across the U.S. In an effort to reduce costs, federal and state officials have also focused on this issue when reviewing requests for capital improvement funds for waste treatment facilities. Two approaches to reducing leakage are (1) listening and (2) a combination of flow measurements and listening, sometimes referred to as a 'water audit.' Listening involves the systematic use of sound-intensifying equipment to locate leaks. The sound waves can be picked up by sensitive instruments to help locate leaks with great accuracy. The water audit is a two-phase survey using flow measurements in the pitot tube flow meter, which can be attached to a photo recording device capable of recording continuous flow rates for 12, 24, or 48 hours. With a field accuracy of plus or minus 2%, this meter can measure flows over a wide range from a few thousand to over 200 million gallons per day. The advantage of just listening is that no excavations are needed to tap the mains; a disadvantage is its limited scope and inability to detect faulty metering. The water audit is comprehensive, and some gauging points must be excavated when necessary. (Garrison-Omniplan)
W82-02521

IN-HOME CONSERVATION AND WASTEWATER MANAGEMENT,
Battelle Pacific Northwest Labs., Richland, WA.
W. J. Hopp, and W. P. Darby.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 401-418, October, 1981. 6 Fig, 7 Tab, 18 Ref.

Descriptors: *Water conservation, *Wastewater management, *Cost-benefit analysis, *Domestic water, Maintenance costs, Construction costs, Operating costs, Grants, Mathematical models, Model studies, Wastewater treatment, Water consumption, Water management, Municipal water.

Household water conservation is a cost effective flow reduction measure to include in the overall strategy of a wastewater utility, according to results of a mathematical model. However, the Federal Construction Grants Program, which funds 75% of construction costs, but none of the costs of conservation devices, is a disincentive. As a result, the maximum cost per conservation device to achieve a 10% reduction in household water flow and still have a positive net present savings is $14.00, versus $46.00 without the grant program. It is suggested that 75% of the conservation device costs be funded to encourage conservation. This would be an important factor in marginal cases. The mathematical analysis uses a net present equivalent method and considers time value of money, inflation, population growth rate, public acceptance of household conservation practices, residential contribution to the treatment plant effluent, and wastewater facility costs (construction, operating, and maintenance). (Cassar-FRC)
W82-02591

3E. Conservation In Industry

AN EVALUATION OF THE POTENTIAL FOR WATER CONSERVATION AND REUSE IN THE GEORGIA PULP AND PAPER INDUSTRY,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
G. Battaglia, E. Hartley, W. Himes, G. Valentine, and C. Wyvill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157991, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology. Report ERC 04-81. June, 1981. 71 p, 20 Fig, 2 Tab, 65 Ref. OWRT-C-90303-C(9453)(1), 14-34-0001-9453.

Descriptors: *Water conservation, *Water reuse, Water consumption, Water use efficiency, Industrial water, Pulp, Paper, *Pulp and paper industry, Surveys, *Georgia.

This study contains an in-depth investigation of water usage patterns in 14 of the largest pulp and paper mills in Georgia responsible for nearly 85 percent of all production in the State. Consideration is given to water supply and water quality which the industry must address, and an identification is made of feasible conservation and reuse techniques the industry should consider. The report contains a tabulation of potential water withdrawal savings in Georgia, if mills practice both normal and potentially feasible conservation and reuse measures.
W82-02456

GEOTHERMALLY POWERED FOOD-PROCESSING SYSTEMS.
Food Engineering, Vol 53, No 10, p 97-100, October, 1981. 4 Fig, 1 Tab.

Descriptors: *Food processing industry, *Heated water, *Geothermal resources, Heating, Wells, Heat exchangers, Energy sources, Groundwater mining.

Geothermal energy can be applied to the food processing industry, according to studies on a hypothetical new corn wet milling plant in East Mesa, California, and an operating frozen food plant in Salisbury, Maryland. In the California plant a 6.6% energy savings could be attained using geothermal heat to preheat the waste gas stream before incineration, the air entering the starch dryer, and the makeup water entering the deaerator. A geothermal/cogeneration system, saving 17.1% energy, would use geothermal water to replace the waste heat used to generate electricity. In the frozen food plant, geothermal water at about 130 F would provide heat for process water by means of a heat exchanger and heat pumps.

Water would leave the heat exchanger at 110-140 F. Energy savings would be 52-80%, depending on the actual well temperature, and steam requirements would be reduced to 0-15% of present steam demands. (Cassar-FRC)
W82-02543

3F. Conservation In Agriculture

PUBLIC PERCEPTION OF GROUNDWATER DEPLETION IN SOUTHWESTERN KANSAS,
Kansas Water Resources Research Inst., Manhattan.
D. E. Kromm, and S. E. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153719, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, 1981. 62 p, 4 Fig, 21 Tab, 42 Ref, Append. OWRT-A-097-KAN(1), 14-34-0001-0118.

Descriptors: *Attitudes, *Groundwater mining, *Irrigation practices, *Water management, Agriculture, Dry farming, Great Plains, *Kansas, Water policy, *Ogallala Aquifer, Perception of groundwater depletion, Water resource agencies.

Reports the awareness, response, and preferred adjustments of various socioeconomic groups with respect to groundwater depletion in southwest Kansas. Occupational differences account for greater variation in knowledge and response than do personal, locational, educational, length of residency, and other characteristics of regional residents. Farmers and those in agribusiness know more about state water law and the proportion of groundwater used to irrigate crops. However, they are significantly less concerned about groundwater depletion, have a much narrower range of regional concerns, and are more pessimistic about the economic future of southwestern Kansas. Most residents, with the exception of irrigators, have not yet had to significantly alter their behavior because of depletion. Respondents seemed especially concerned about future problems, however, and appear highly receptive to an active groundwater conservation program. Irrigators had more divergent preferences for various adjustments than any other socioeconomic group. Large-scale irrigators report significantly greater changes in water use practices than smaller operators and appear more receptive to new programs. Although measuring preferences for all groups reveals a wide range of acceptable adjustments to groundwater depletion, there is not a regional consensus on a viable management program or the governmental agencies that should have responsibility.
W82-02174

AERATED DRIP IRRIGATION,
Bonniville County Farm Bureau, Idaho Falls, ID.
W. Anderson.
In: Farm Bureau Energy Idea Symposium Proceedings, November 18-19, 1980, Des Plaines, Illinois. P 12-28. 10 Fig. (1980). American Farm Bureau Federation, Park Ridge, Illinois.

Descriptors: *Drip irrigation, Agricultural hydrology, *Irrigation, Water use, Crop yield, *Crop production, *Potatoes, Corn, Carrots, Farming, Water conservation, Sand filters, *Idaho.

An aerated drip irrigation system is described by a potato farmer in Idaho as having nearly doubled his potato yields and hastened their maturity. Even though the cost per acre of drip irrigation is higher than other methods in the potato industry, the cost per bag is lower and the net return is over four times as high. The system uses T-tapes involving quarter-mile-long-runs---far longer than the typical drip irrigation of 200-300 foot runs, and perhaps the longest in the world. The tape, which lies flat and can be driven over with tractors, runs on a 36-inch row, and costs approximately $350 per acre. Filters are filled with No. 20 blasting sand, and are used in pairs so that clean water coming through one will backflush and float all the debris out of that filter onto the ground or into a settling pond. Each filter will handle approximately 125-150 gallons per minute. The system saves 75 percent of energy costs and reduces water need for irrigation by 50 percent. Since the water is applied at the root zone, there is an estimated 50 percent reduction in fertilizer use. The pH of the water can be changed with sulphuric acid, phosphoric acid, or whatever acid the plant needs, and can be applied right in the root zone. The water pressure throughout the system is 8 PSI. In addition to potatoes, aerated drip irrigation was used on carrots and corn. Some of the carrots grew to two feet in length, and the yield of sweet corn on several acres was double, with twice as many ears as expected. Another farmer has been pleased with the yield from drip-irrigated raspberries. (Garrison-Omniplan)
W82-02186

SOLAR HEAT POND SYSTEM,
Howard County Farm Bureau, Nashville, AR.
B. Kreul.
In: Farm Bureau Energy Idea Symposium Proceedings, November 18-19, 1980, Des Plaines, Illinois. P 65-68. 1 Fig. (1980) American Farm Bureau Federation, Park Ridge, Illinois.

Descriptors: *Solar energy, Solar radiation, Energy, *Heated water, *Crop yield, Tomatoes, *Greenhouses, Heat, Farming, Cold resistance, Insulation, Heating, *Experimental design, Costs.

A prototype solar collector, in the process of being built for use at a greenhouse, has a 3,000-gallon reservoir for the heat storage mass and a corrugated aluminum collector plate. The system's total maximum heat collection during an average year is approximately 26 million Btus. Thus, while it cost $1,700 to construct, it will probably save $300-$600 per year in fuel costs. The capacity of the system could be doubled at a probable cost of $2,300. The water pit itself is earth-formed and double-lined with plastic and insulating material. The cover is operated by an electric winch that closes it at night. While the designers call it a 'solar pond' system, there is no salt layer as in typical solar ponds. Instead, there is a film of ultraviolet-resistant polyethylene over the pond to prevent thermal convection losses from the surface. The plans also call for a simple thermostatic system that shuts the system down when the water temperature cools down to a certain point, such as 60 degrees; at that point, the gas-fired system thermostats activate to provide heat. Pipes distribute the water from the reservoir to the collector plate surface, and the cool water is returned to the pond. Convection tubing distributes the warm air down the length of the greenhouse. The collector plate will be elevated out of the water and the water will circulate over it by means of a pump. The system was constructed from materials available at hardware stores. Other kinds of reflectors that could also work would be spherical or parabolic sections. (Garrison-Omniplan)
W82-02187

LOOP EQUATIONS WITH UNKNOWN PIPE CHARACTERISTICS,
IBM Scientific Center, Haifa (Israel).
E. Gofman, and M. Rodeh.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY9, p 1047-1060, September, 1981. 6 Fig, 7 Ref.

Descriptors: *Water distribution, *Irrigation operation, *Computer programs, Networks, Head generators, Loop equations, Pipes, Hydraulic engineering, Water pressure, Pressure head.

Water distribution networks, such as irrigation systems, may be easily analyzed with an interactive computer program using the concept of loop oriented hydraulic network solvers rather than node equations. The concept of head generators is introduced to describe the resistance in a pipe of unknown characteristics. A positive resistance might indicate that a regulating valve should be partially closed and a negative resistance may show the need for a booster. The method was extensively tested during 1978-80 in Israel and found useful for both design and operation of water distribution networks. Large networks with 300 pipes and 25 loops were efficiently solved on a portable computer. The program was easily used by engineers, students, and farm managers. (Cassar-FRC)
W82-02258

SOLID SET IRRIGATION SYSTEM DESIGN USING LINEAR PROGRAMMING,
Ben-Gurion Univ. of the Negev, Sde-Boker (Israel). Inst. for Desert Research.
For primary bibliographic entry see Field 6A.
W82-02273

LEAF PHOTOSYNTHESIS, LEAF PERMEABILITY, CROP GROWTH, AND YIELD OF SHORT SPRING WHEAT GENOTYPES UNDER IRRIGATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 2I.
W82-02373

EFFECTS OF SALINIZATION TREATMENTS ON GROWTH AND SOME RELATED PHYSIOLOGICAL ACTIVITIES OF SOME LEGUMINOUS PLANTS,
Assiut Univ. (Egypt). Dept. of Botany.
A. M. Ahmed, M. M. Heikal, and M. A. Zidan.
Canadian Journal of Plant Science, Vol 60, No 2, p 713-720, April, 1980. 5 Tab, 29 Ref.

Descriptors: *Saline soils, *Crops, Sodium, Transpiration, Water supply, *Legumes, Vegetation, Farming, Salinity, Chemical properties, Soil properties, Soil types.

A study was conducted on the effect of various NaCl concentrations on plant-water relationships, mineral composition, pigment content, photosynthetic activity and dry matter production in legumes. When subjected to salinization levels of 20, 40 and 60 meq NaCl/liter the kidney bean cultivars Harvester and Contender and cowpea cultivars Asmarly and Creamy 7 exhibited significant changes in their physiological activities. The trends and magnitudes of these changes depended on the plant variety and on the level of salinization. In general, while stomatal frequency and transpiration rate were significantly reduced, water content was considerably elevated. Biosynthesis of pigments and photosynthetic activity and consequently leaf area and dry matter accumulation were considerably reduced as the concentration of NaCl in the nutrient medium increased. Mineral composition also exhibited significant changes, but the dominant feature was the high accumulation of sodium in salinized plant tissues. These cultivars should be regarded as saline sensitive and not as suitable for cultivation in saline soils. Water content in the different organs of each of the four treated cultivars was elevated with the rise in salinization level, except for Asmarly roots, in which it was reduced. This increase in water content was attributed to a decrease in the rate of transpiration. (Baker-FRC)
W82-02381

WATER FOR NEW ZEALAND'S PLAINS,
UOP Inc., Kirrawee (Australia). Johnson Div.
R. McCallum.
Johnson Driller's Journal, Vol 53, No 1, p 10, 1981.

Descriptors: *Irrigation wells, *Wells, *Irrigation engineering, *New Zealand, Water resources development.

Drilled wells in the prolific sand-gravel aquifers in New Zealand's Canterbury plains supply irrigation water for the extensive agricultural area. A typical recent installation consisted of a 12 inch well, 130 feet deep, developed with a solid surge block yielding 336 igpm. It was fitted with a 60 kw Pleuger electric submersible pump at 80 ft. A 6 inch PVC buried pipe supplies 6 hydrant take-off points. A 4-span Rotogator center pivot unit applies 3 inches per pass every 25-30 days. (Cassar-FRC)
W82-02402

A MANAGEMENT SYSTEM FOR THE CONJUNCTIVE USE OF RAINFALL AND LIMITED IRRIGATION OF GRADED FURROWS,
Science and Education Administration, Bushland, TX. Conservation and Production Research Lab.
B. A. Stewart, D. A. Dusek, and J. T. Musick.
Soil Science Society of America Journal, Vol 45, No 2, p 413-419, March/April, 1981. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Irrigation design, *Furrow irrigation, Irrigation efficiency, Irrigation operation, Furrows, Irrigation, Furrow drainage, Water use efficiency.

An effective management system was sought which would meet various requirements, such as permitting application of irrigation water without allowing water to leave the field; permit conjunctive use of rainfall by eliminating or minimizing runoff, even when rainfall closely follows irrigation; and permit efficient utilization of applied water for crop production. Under this plan a 600 meter field was divided into three water management sections. The upper half of the field was managed as fully irrigated. The next fourth was a tail-water-runoff section that used furrow from the fully irrigated section. The lower one-fourth section was designed as a dryland section, retaining and using any runoff, generated either by irrigation or by rainfall, from the water, fully irrigated or tailwater-runoff sections. Furrow dams were an important part of the system design. Seeding rates were reduced down the field from 6 kg/ha in the fully irrigated section to 3 kg/ha on the tailwater section, to 1.5 kg/ha on the dryland section. Nitrogen applications were similarly reduced. For 1979, a year with near average rainfall, the system succesafully prevented runoff from both irrigation and rainfall. (Baker-FRC)
W82-02556

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

HISTORICAL BACKGROUND AND OVERVIEW OF PLAN FOR RESTORING FRESHWATER INFLOW TO AN ESTUARY IN CONJUNCTION WITH URBAN DEVELOPMENT,
Larsen and Associates, Miami, FL.
P. Larsen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981, p 201-211, 7 Fig, 3 Ref.

Descriptors: *Estuaries, *Wetlands, *Mangrove swamps, *Land development, Construction, Drainage effects, Laminar flow, Flow pattern, Flood control, Urbanization, *Florida.

Marco Island is located in a mangrove estuarine area on the southwest coast of Florida. When the project started in 1964, State and Federal regulations encouraged the development of waterfront communities in mangrove areas. Initial plans called for dredging and filling large portions of the 19,500 acre original ownership area. The Marco Island development proceeded concurrently with changing wetlands regulations, and eventually permits to develop 31% of the Marco Island plan were denied. The developer has proposed a substitute plan for development of 1,500 acres of uplands and 2,500 acres of wetlands located near the estuary. A key feature of the new plan is the proposed restoration of freshwater inflow to fringing estuarine wetlands impacted by prior construction of roads and drainage works. The proposed plan for restoring freshwater inputs to the estuary is based upon blocking all channelized flows that presently leave the site. Real estate lakes will be constructed in uplands and in impacted freshwater wetlands immediately upgradient. Freshwater outflow from the lakes will be delivered to the estuary via sheet flow across preservation wetlands. The lake system is designed to initially retain a 100-year, 24-hour storm. During dry periods groundwater inputs to the lake will be routed to spreader ditches and then to wetland surface flow instead of lost to drainage ditches. (Moore-SRC)
W82-02119

FRESHWATER INTRODUCTION INTO LOUISIANA COASTAL AREAS,
Army Engineer District, New Orleans, LA.
J. C. Weber, and R. A. Buisson, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81-04, Vol I, Oct. 1981. p 366-375, 3 Fig, 4 Ref.

Descriptors: *Wildlife conservation, *Salinity, *Estuaries, *Diversion structures, Planning, Coastal waters, Local governments, Benefits, Freshwater inflow, *Louisiana.

The conservation and enhancement of fish and wildlife resources through the control of salinities in portions of the estuarine area of Louisiana are the purposes of one authorized project and two ongoing studies in the U. S. Army Engineering District, New Orleans. The primary measure identified for controlling salinities is to divert water from the Mississippi River near the delta to adjacent estuarine areas. Planning and implementing this type of project presents a challenge from both technical and institutional standpoints. Technically, the state-of-the-art for quantifying benefits and impacts must rely on expert judgment and assumptions. From the institutional aspect, freshwater diversion is supported by many Federal, State, and local agencies and organizations. However, obtaining local cooperation and support for specific diversion sites may be the most difficult problem to solve because the local areas where diversion facilities would be located are not necessarily the areas receiving significant benefits from diversion. In some areas, benefits may not outweigh adverse impacts involved with constructing and operating diversion facilities. For the most part, benefits would be widespread and would accrue to interests not directly participating in the project.
W82-02127

ESTABLISHMENT OF CONTROLLED FRESHWATER DIVERSIONS OF THE MISSISSIPPI RIVER INTO THE LOUISIANA COASTAL ZONE,
Department of Natural Resources, Baton Rouge, LA.
M. E. Crandall, and J. L. Lindsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Smyposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 139-146. 3 Fig, 6 Ref.

Descriptors: *Estuaries, *Erosion, *Wetlands, *Coastal zone management, Regulations, Diversions, Costs, Planning, Estuarine fisheries, Productivity, Resources management, Mississippi River, Louisiana.

Dredging of the channel and construction of levees along the Mississippi River, together with the absence of freshwater introduction at the upper ends of the hydrologic basins, have set up a positive feedback loop leading to increased land loss. Coastal wetland is being lost at a rate of 16.5 sq miles per year. This land loss is a cause of reduced productivity of area fisheries. There are two approaches to alleviate the problem: regulation, and programs to restore or mimic the natural processes of the system. Regulations have been developed, but their use can only retard the aggravation of the deterioration process. Freshwater diversions to restore natural conditions may be large or small scale. The small scale diversions are more practical because of their smaller cost and shorter-term planning. Both are likely to face problems of local funding difficulties, user conflicts, land user changes, and general distrust of projected results. A combined local, state and federal effort is necessary for the positive effects of freshwater diversions into Louisiana's estuarine system can become a reality. (Brambley-SRC)
W82-02145

THE MOUTH OF THE COLORADO RIVER PROJECT; AN ECONOMIC DEVELOPMENT ENVIRONMENTAL ENHANCEMENT PROJECT,
Army Engineer District, Galveston, TX. Engineering Div.
J. C. Trahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 166-178. 2 Fig, 5 Ref.

Descriptors: *Colorado River, *Texas, *Estuaries, *Navigation, *Channel improvement, *Diversion channels, Dams, Planning, Economic evaluation, Fisheries, Deltas, Marshes, Land development, Water management.

The Mouth of the Colorado River (Texas) Project was originally intended to be only a navigation project but was expanded to include a diversion project. The Project will provide a jettied entrance channel in the Gulf of Mexico at the mouth of the river; a navigation channel to Matagorda; a diversion channel and dam to divert the flow of the river into Matagorda Bay; and related improvements. A history of project planning is presented to illustrate both interagency conflicts over data needs and proper reporting procedures and interagency cooperation on the studies finally conducted. The studies, which include an economic evaluation of the benefits of river diversion and a delta growth projection based on an in situ sediment study, mathematical modeling, a bay-bottom coring program, and a hydrographic survey are described, and the results of the study are presented. Because the studies show that a river delta of valuable intertidal marsh habitat would form and that additional freshwater inflow would significantly enhance the fishery, construction of the river diversion project is recommended. The project described illustrates the conflicting needs involved in freshwater inflow decisions and the complex data requirements of the decision process, and emphasizes that, because definitive scientific answers to inflow issues are often unavailable, a cooperative attitude among the affected parties is essential if results are to be achieved. (Brambley-SRC)
W82-02148

LOSS OF COLORADO RIVER INFLOWS TO MATAGORDA BAY, TEXAS, AND EFFORTS FOR RESTORATION,
W. J. Sheffield, and M. T. Walton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 216-229. 1 Fig, 2 Tab, 37 Ref.

Descriptors: *Diversion channels, *Colorado River, *Texas, *Environmental effects, *Shellfish, *Estuarine environment, Cost-benefit analysis, Planning, Navigation, Estuarine fisheries, Channelization.

Major disturbances to the Matagorda Bay system have included diversion of the Colorado River to the Gulf of Mexico and loss of supporting marshes. Supporting marshes have been reduced from

18,623 ha (46,000 acres) to 15,789 ha (39,000 acres) and oyster reefs have been reduced in area from 11,660 ha (28,800 acres) in the late 1800's to 8,291 ha (20,480 acres) at present with only one-fourth of this area consistently productive. Oyster production has decreased because parasitic infestations have increased in response to increases in salinity. Production of shellfish in West Matagorda Bay is estimated to be only 20% of that possible through utilization of environmental management. Methodologies for calculating potential changes in shellfish production due to rediversion of the Colorado River are presented. Annual economic benefits for increased shellfish production in West Matagorda Bay and Gulf of Mexico attributable to rediversion are estimated to be in excess of $17.1 million. Significant actions relating to the Mouth of Colorado River Texas Project, sanctioned by Section 101 of the Rivers and Harbor Act of 1968, include separation of project features by the Crops of Engineers, restoration of the diversion feature to the project, and delay in navigation feature construction due to threats of legal action. A project to link East Matagorda Bay to the Colorado River Channel is suggested, to provide permanent access from East Matagorda Bay to the Gulf of Mexico. (Brambley-SRC)
W82-02151

SANTEE-COOPER REDIVERSION: PROJECTED IMPACTS ON FISHERY RESOURCES AND WILDLIFE HABITATS,
Fish and Wildlife Service, Cookierville, TN.
L. A. Barclay, Jr., and V. G. Burrell, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 463-473. 1 Fig, 20 Ref.

Descriptors: *Environmental effects, *Partial diversion, *Santee River, South Carolina, *Sediment control, *Fisheries, *Wildlife habitats, Oysters, Clams, Shrimp, Salt marshes, Brackish water, Population dynamics.

The fresh water from the Santee River drainage basin was diverted through the Santee-Cooper hydroelectric plant into the Cooper River in 1942. This increased the average flow in the Cooper River from 72 cfs to 15,600 cfs, and concomitant sediment resulted in a tremendous increase in shoaling in Charleston Harbor. The U.S. Army Corps of Engineers has initiated a project to alleviate this shoaling problem by rediverting most of this fresh water back into the Santee channel and reducing the average weekly flow in the Cooper River to approximately 3,000 cfs. This rediversion is scheduled to be completed in 1982. It is projected that fish and wildlife resources will be subjected to substantial impacts as a result of rediversion. Highly productive oyster and clam beds will be displaced or destroyed, as will valuable shrimp and finfish nursery areas. Severe reduction of freshwater flows into the Cooper River drainage will result in the displacement of freshwater and brackish marsh vegetation by saltmarsh plants; conversely, increases in freshwater flows into the Santee River drainage will cause salt marsh and brackish marsh vegetation to be succeeded by freshwater plants. These vegetative changes will cause profound changes in the wildlife populations of these two river drainages.
W82-02168

SEDIMENT TRANSPORT DURING A CONTROLLED RESERVOIR RELEASE,
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 2J.
W82-02196

BIOLOGICAL CONTROL OF AQUATIC WEEDS IN SOUTHWEST FLORIDA,
Lee County Hyacinth Control District, Fort Myers, FL.
J. R. Cassani, and T. Y. Miller, Jr.
Journal of Aquatic Plant Management, Vol 19, p 49-50, July, 1981. 1 Fig, 6 Ref.

Descriptors: *Aquatic weed control, Weed control, *Florida, Water hyacinth, Alligatorweed, Aquatic plants, Insects, Arthropods, Fish, Herbicides, Plant diseases, Carp.

The biological aquatic weed control program in the Lee County Hyacinth Control District is described. Three major types of biotic agents being used or investigated are phytophagous arthropods, herbivorous fish, and pathogens. Water hyacinth weevil (Neochetina eichhornia Warner) and a related species were released in 1974, but only the former is distributed and destroying weeds extensively. Sameodes albiguttalis Warner has produced a severe infestation on water hyacinth in the Manatee River. Alligatorweed flea beetle (Agasicles hydrophila) populations are highest in December-April, and dormant in hot weather. At least 16 sites in southwest Florida have been stocked with grass carp or with a hybrid fish (female grass carp and male hybrid bighead carp). These are monitored quarterly and have been found partially successful. Limited research on bacterial and fungal pathogens is underway. (Cassar-FRC)
W82-02285

CONTROL OF AQUATIC WEEDS WITH HEXAZINONE,
Science and Education Administration, Davis, CA.
L. W. J. Anderson.
Journal of Aquatic Plant Management, Vol 19, p 9-14, July, 1981. 7 Fig, 1 Tab, 18 Ref.

Descriptors: *Aquatic weed control, *Herbicides, *Hexazinone, Weed control, Toxicity, Ponds, Algae, Phytoplankton, Macroinvertebrates, Invertebrates, Fate of pollutants, Water quality, Species diversity, Aquatic plants, Water pollution effects.

In an aquatic weed control trial, 0.97 kg of the herbicide hexazinone was applied to a 0.08 ha pond to produce a 1 ppm concentration in water. The following weeds were completely controlled: American pondweed (Potamogeton nodosus Poir.), Sage pondweed (P. pectinatus L.), elodea (Elodea canadensis Michx.), cattail (Typha sp.), Spirogyra sp, slender spikerush (Eleocharis ocicularis L.), and Chara sp. Root to shoot translocation was observed in cattails and Russian olive trees. Decaying vegetation caused a drop in dissolved oxygen from 8 ppm to 0.2 ppm within 5 days after treatment, causing a fish kill. Oxygen levels remained at 1-4 ppm during the remainder of the 4-month study. Decomposing plant tissue also released P and N compounds into the water. The species diversity index of periphyton fell to a low of 0.2 by 98 days post treatment (control pont, 1.5-2.0) and recovered to 0.5 by 119 days. The species diversity index of macroinvertebrates deteriorated to 0.4 by the 52nd day and recovered to 1.3-1.5 by the end of the study. The control pond index was 1.5-2.5. Observations 1 year after herbicide application indicated no regrowth of plants except for phytoplankton and benthic algae. A bioassay showed no residual phytotoxicity in water or sediment. (Cassar-FRC)
W82-02326

DIQUAT AND SODIUM ALGINATE FOR WEED CONTROL IN RIVERS,
Agricultural Research Council, Oxford (England). Weed Research Organization.
P. R. F. Barrett.
Journal of Aquatic Plant Management, Vol 19, p 51-52, July, 1981.

Descriptors: *Herbicides, *Aquatic weed control, *Diquat, Weed control, Rivers, Aquatic plants, *Eden River, *England, Sodium alginate, Gels, Invertebrates, Benthic fauna, Water quality.

Diquat in a sodium alginate carrier allowed local control of aquatic weeds in the River Eden, Cumbria, England, with little apparent adverse effect on the invertebrate fauna. Experiments were conducted during low water (discharge 7 cu m per sec) in June of 1977 and 1978. A viscous solution of 100 g diquat cation in 1 liter sodium alginate solution (30 g per liter) completely destroyed weed beds (largely Ranunculus fluitans Lam. and Ranunculus penicillatus Butcher C D K Cook) and created clear channels up to 40 min or 120 min. The other treatments were: 100 g diquat in 5 liters water (no carrier) and 100 g diquat-sodium alginate diluted with river water to 5 or 10 liters. Of these, only the diluted diquat-alginate applied over the 120 min period produced nearly complete weed removal. Very few or no weeds were killed by the other procedures. It is likely that the alginate method will be acceptable in regions where high water quality is a concern. (Cassar-FRC)
W82-02328

PRELIMINARY EVALUATION OF HYDROGEN PEROXIDE AS A POTENTIAL HERBICIDE FOR AQUATIC WEEDS,
Science and Education Administration, Stoneville, MS. Southern Weed Science Lab.
P. C. Quimby, Jr.
Journal of Aquatic Plant Management, Vol 19, p 53-55, July, 1981. 1 Tab, 11 Ref.

Descriptors: *Hydrogen peroxide, *Aquatic weed control, *Herbicides, Weed control, Aquatic plants, Alligatorweed, Water hyacinth, Coontail, Hydrilla, Toxicity, Fish.

Hydrogen peroxide proved effective as a herbicide for aquatic weeds. Coontail and hydrilla were exposed in the laboratory to 1, 2, 3, and 4 nM of H_2O_2 for 1, 30, and 60 min and 5 days. Acceptable weed suppression (90-100%) was seen at 1 nM for the 5-day exposure. Guppies in the water were not injured during this test. Other treatments which were > 80% effective were the 60 min exposure to the 3 and 4 nM concentrations. A 1 min exposure at the highest peroxide concentration produced 0-20% suppression, and a 30 min exposure, 70-80%. No effects on emersed alligatorweed or floating water hyacinth were seen at the concentrations used in this study, showing its selectivity toward submerged weeds. (Cassar-FRC)
W82-02329

GROWTH AND PHOTOSYNTHESIS OF NAJAS MARINA L. AS AFFECTED BY LIGHT INTENSITY,
Tel Aviv Univ. (Israel). Dept. of Botany.
M. Agami, S. Beer, and Y. Waisel.
Aquatic Biology, Vol 9, No 3, p 285-289, 1980. 3 Fig, 6 Ref.

Descriptors: *Aquatic plants, *Plant growth, *Photosynthesis, *Light intensity, *Najas marina, Reservoirs, Light penetration, Water pollution control, Water levels, Water supply, Aquatic weed control, *Israel.

Marked reduction in growth of Najas marina was observed in slightly increased water depths, suggesting that short periods of water level alteration could control this nuisance plant in reservoirs without the use of polluting chemicals. Najas plants grew uniformly in the upper 50 cm of water and increased their net weight to a lesser degree between 50 and 100 cm depth. At depths of 200-250 cm the plants grew for the first week (probably from stored carbohydrate reserves), kept the same weight for the second week, and deteriorated during the third week. Studies were conducted in August, the optimum growth season of the plant. Light intensities were 360 micro-units per sq m-sec at 50 cm depth, 60 micro-units at 100 cm, and below the compensation point, 1.5 micro-units, at 200-250 cm. Light saturation was reached at 280 micro-units per ssq m-sec, and the light compensation point for net photosynthesis was 5 miccro-units per sq m-sec (depth of 170 cm). Najas growth may be affected by the month of the growing season, changes in water level or turbidity, or algal blooms. (Cassar-FRC)
W82-02365

METHODS OF RESTORING THE DELIVERY OF DRAINAGE WELLS,
V. S. Alekseev, and V. T. Grebennikov.
Hydrotechnical Construction, No 1, p 24-28, January, 1980. 2 Fig, 1 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 1, p 15-17, January, 1980.

Group 4A—Control Of Water On The Surface

Descriptors: *Drainage systems, *Flood control, Flood protection, Permeability, Maintenance, *Drainage wells, Wells.

Field studies were conducted to determine the effectiveness of different methods of restoring the yield of drainage wells. The drainage system examined is a linear row of wells with a total length of 7.9 km located parallel to and at a distance of 150 meters from a protective dike. The distance between wells is 12-25 m. The wells drain the pressure-free aquifer of ancient alluvial deposits both above and in the Volga River terrace. The permeability of the stratum increases from 5-20 m/day in the south to 60-80 m/day in the north. The waters contain calcium hydrocarbonates, with a mineral content of up to 900 mg/liter. The pH varies from 7.3 to 8.2, and the total iron concentration reached 30 mg/cu dm. During the operation of a drainage system, the reduction in well productivity is governed by chemical silting processes, the rate of which is determined by the design of the permeable portion of the well. Use of the pneumatic-impulse treatment of wells with an interrepair period of not more than 6 months is possible in wells that have been in service not longer than 3-4 years. Wells in service for 5-10 years can be treated by detonation of a blasting fuse to restore 45-65% of initial yield. Solution of silting formation for a 6-7 year old well is ensured by concentrated hydrochloric acid and powdered reagents. Interrepair periods for this treatment method range from 18-24 months. Combined treatment methods are expedient in wells in service for more than 7-8 years where interrepair periods of 24-30 months have been observed. Experience acquired with massive restoration of drainage productivity in wells in this flood-control system can be used to develop measures which will stabilize the effect of verticle drainage of terrace dams and flood-protection systems under similar hydrogeologic conditions. (Baker-FRC)
W82-02385

WATERLOGGING CONTROL FOR IMPROVED WATER AND LAND USE EFFICIENCIES: A SYSTEMATIC ANALYSIS,
Colorado State Univ., Fort Collins. Water Resources Research Inst.
For primary bibliographic entry see Field 6A.
W82-02455

REASSESSMENT OF THE EFFECTS OF CONSTRUCTION DEWATERING ON GROUNDWATER LEVELS IN THE COWLES UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA. SUPPLEMENT TO GEOLOGICAL SURVEY WATER-RESOURCES INVESTIGATIONS 78-138,
Geological Survey, Indianapolis, IN. Water Resources Div.
D. C. Gillies, and W. W. Lapham.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Prices: $7.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1105, September, 1980. 50 p, 23 Fig, 3 Tab, 4 Ref.

Descriptors: *Settling basins, *Ponds, *Fly ash, *Seepage, Water level, *Dewatering, Groundwater, Groundwater movement, Aquifers, Construction, Model studies, Hydrogen, Surface-groundwater relations, *Indiana, Indiana Dunes National Lakeshore.

A revised dewatering plan for the construction of a nuclear power plant at the Northern Indiana Public Service Company's (NIPSCO) Bailly Generating Station and evidence that suggests that a change in the characteristics of the confining unit 2 in and near Cowles Bog National Landmark may exist have resulted in a reassessment of the effects of construction dewatering on ground-water levels in the Indiana Dunes National Lakeshore. Model results indicate that the revision in the dewatering plan produces water-level declines that do not differ significantly from those described previously. However, when the change in the confining unit beneath Cowles Bog is considered, simulations of the simultaneous decline of a seepage mound after sealing of the fly-ash-ponds and the second phase of construction dewatering indicate that the simulated water-level declines in the aquifer unit 1 at Cowles Bog may be below the water levels tolerated by the National Park Service after 18 months. The water levels may even decline below the tolerable levels in spite of NIPSCO's proposed plan of artificially recharging the aquifer unit 1 near the excavation site at 400 gal/min. The magnitude of the simulated water-level declines in unit 1 within the Lakeshore, caused by pumping from the excavation, depends on the relation in time between the second phase of dewatering and the decline of the seepage mound after sealing of the fly-ash-ponds, but not on the duration of dewatering beyond 18 months. (USGS)
W82-02478

OPERATION POLICY ANALYSIS: SAM RAYBURN RESERVOIR,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 6A.
W82-02589

WETLANDS USE FOR WATER MANAGEMENT IN FLORIDA,
Corvallis Environmental Research Lab., Cincinnati, OH.
D. C. Ammon, W. C. Huber, and J. P. Heaney.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 315-327, October, 1981. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Wetlands, *Water management, *Runoff, *Florida, *Kississimmee River Basin, Lake Okeechobee, Flood control, Marshes, Swamps, River basins, Drainage, Phosphorus, Water quality, Water resources, Weirs, Water supply, Nutrient removal, Outlets, Runoff, Detention dams.

A basin-wide water management scheme has been proposed for the Kissimmee River basin, Florida. This 2300 sq mi area contributes a major portion of surface inflow and nutrient loads to Lake Okeechobee, which is the primary water resource for southern Florida (irrigation water, maintenance of Everglades National Park, aquifer recharge, municipal supply, recreation, wildlife habitat, and flood control). By 1972 the basin hydrology had been altered by a 53 mile channel so that rapid runoff was characteristic. The management plan is based on detention of runoff, restrictions of surface water discharge rates, and routing flow through marshes. A representative wetland, Chandler Slough Marsh (1000 acres) was chosen as the study area. Simulation analyses showed it to be moderately effective as a quality and quantity control unit. Detaining surface runoff would increase detention time and produce a larger proportion of subsurface pathways, reducing inflow peaks and nutrient concentrations to the downstream marsh. Construction of a weir system would produce greater nutrient removal from the water but more frequent inundation of surrounding areas. In addition, it would bar the periodic flushing of nutrients and dead vegetation that prevents nutrient buildup. (Cassar-FRC)
W82-02590

COMPARISON OF DETENTION BASIN PLANNING AND DESIGN MODELS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-02592

LARM TWO-DIMENSIONAL MODEL: AN EVALUATION,
Tennessee Technological Univ., Cookeville.
J. A. Gordon.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 877-886, October, 1981. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Reservoir management, *Water temperature, *Flow patterns, Water management, Model studies, LARM model, *Center Hill Lake, *Tennessee, Lakes, Temperature, Water quality, Dissolved oxygen, Oxygen, Hydrodynamics, Stratification, Weirs, Simulation analysis, Flow control, Flow velocity, Outlets.

A laterally averaged reservoir model (LARM) was used to investigate the flow regimes of Center Hill Lake, Tennessee, during the dry year 1972 and the wet year 1973. This numerical, two-dimensional model combines the mass continuity, momentum, and energy equations and computes temperature and flow velocity vectors resulting from raised or multilevel power outlets. Predicted outflow temperatures for 9 dates (April to September) were very close to measured temperatures. The model realistically handled periods of isothermal to spring stratification, fall overturn, and flood conditions. Outflows, inflows, and reverse flows were all depicted by the model. Different outlet levels were simulated to predict effects on hydraulic residence time and dissolved oxygen levels. Using a raised outlet kept the hypolimnion cooler, discharge waters about 5C warmer, and inflow patterns the same as the normal level outlet. Hydraulic retention time in the metalimnion was 98 days with the raised outlet and $>$ 155 days with the normal outlet. Simulation of a submerged weir from the bottom to 12 meters below the surface showed temperature discontinuities much smaller than expected. (Cassar-FRC)
W82-02597

4B. Groundwater Management

PUBLIC PERCEPTION OF GROUNDWATER DEPLETION IN SOUTHWESTERN KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 3F.
W82-02174

HYDROLOGIC MAPS OF OGALLALA AQUIFER, WEST-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02475

REASONABLE GROUNDWATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: THE LAW AND UNDERLYING ECONOMIC GOALS,
For primary bibliographic entry see Field 6E.
W82-02503

INDUCED SINKHOLES: AN ENGINEERING PROBLEM,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
J. G. Newton.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 107, No IR2, p 175-185, June, 1981. 3 Fig, 13 Ref.

Descriptors: *Sinks, *Carbonate rocks, *Geohydrology, *Water table profiles, *Drawdown, Engineering, Project planning, Groundwater, Geologic joints, Geologic fractures, Faults, Fissures, Geologic formations, Bedrock, Pumpage.

Conditions under which man-made sinkholes develop are described. Induced sinkholes are divided into two types: those resulting from a decline in the water table due to groundwater withdrawls and those resulting from construction. Most induced sinkholes occur where cavities develop in residual or other unconsolidated deposits overlying openings in carbonate rocks. Thd downward migration of the deposits into underlying openings in bedrock and the formation and collapse of resulting cavities are caused by a decline in the water table resulting in induced recharge and other changes in groundwater movement. Most sinkholes from construction are related to the diversion of drainage over openings in bedrock. (Titus-FRC)
W82-02559

MANAGEMENT OF INTERSTATE AQUIFER SYSTEMS,
Camp Dresser and McKee, Inc., Walnut Creek, CA. Water Resources Div.
H. O. Banks.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 563-577, October, 1981. 2 Fig, 10 Ref.

Descriptors: *Groundwater management, *Water law, *Aquifers, *Aquifer management, *Interstate compacts, Water resources development, Water supply development, Water management, Legal aspects, Economic aspects, International agreements, Management planning, Local governments.

The management of interstate aquifers, specifically, the Ogallala Aquifer and the Rio Grande Valley is examined. Regional models that could be expanded to include comprehensive groundwater resources management include federal interstate compacts, interstate compacts, river basin commissions, regional federal agencies, and regional federal-state commissions. Local gencies formed under statutory authority in Colorado, Kansas, Texas and Nebraska have taken limited interstate management actions for the Ogallala Aquifer. The management of groundwater resources by smaller districts is often hampered by limited financial resources. There is little public support for interstate management programs. The Six-State High Plains-Ogallala Aquifer Regional Resources Study was begun to improve the water supply situation of the areas served by the Ogallala Aquifer. The use and allocation of surface waters of the Rio Grande below Elephant Butte are governed by a treaty with Mexico, court decisions, interstate compacts and the water sales contract under the Rio Grande Project. Nine factors relevant to the development of an interstate management program are discussed. The legal and institutional factors that must be considered in formulating a groundwater resource management structure are influenced by social, environmental, and economic goals. A management program formulated and implemented under a regional water resource management commission is recommended to handle the specific aquifer interests of the states involved. (Geiger-FRC)
W82-02578

4C. Effects On Water Of Man's Non-Water Activities

FLOW REGIME AND SEDIMENT LOAD AFFECTED BY ALTERATIONS OF THE MISSISSIPPI RIVER,
J. R. Tuttle, and A. J. Combe, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 334-348, 8 Fig, 6 Ref.

Descriptors: *Sediment load, *Flow discharge, *Channel improvement, *Navigation, *Estuaries, Flood flow, Diversion losses, Sediment transport, Overland flow, *Mississippi River.

Alterations of the Mississippi and Atchafalaya Rivers over the past 140 years have significantly affected the distribution of flow and sediment loads entering the estuaries of south Louisiana. The most significant alterations were: removal of the Atchafalaya River log raft and subsequent alterations which hastened natural processes; confinement of flood flows by levees limiting discharges to three specific outlets; and those alterations that caused a 50% reduction in average annual suspended sediment loads transported by the Mississippi and Atchafalaya Rivers. The average volume of flow delivered annually to south Louisiana has not been affected by alterations. The average annual volume of water transported by the Mississippi below the latitude of Red River Landing has decreased due to increased diversions to the Atchafalaya River since the middle 1800's. Developments in the Atchafalaya Basin, following actions of the State of Louisiana to establish navigation in the middle 1800's, have significantly hastened the natural enlargement processes in the Atchafalaya Basin and Atchafalaya Bay. Channel enlargements in the middle and lower reaches of the Atchafalaya Basin have been instrumental in channeling sediments to the Atchafalaya Bay, reducing the potential for overbank sedimentation in the acceleration of a significant marsh area in Atchafalaya Bay. (Moore-SRC)
W82-02125

BIOLOGICAL CONSIDERATIONS RELATED TO FRESHWATER INTRODUCTION IN COASTAL LOUISIANA,
Army Engineer District, New Orleans, LA.
D. L. Chew, and F. J. Cali.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 376-386, 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Estuarine environment, *Salinity, *Wetlands, *Wildlife, *Saline water intrusion, Environmental effects, Floods, Sediments, Nutrients, Fish, Shellfish, Marshes, Salt marshes, Coastal marshes, *Louisiana.

Louisiana has experienced a rapid loss of coastal wetlands due to natural processes such as subsidence and erosion, as well as man's engineering activities including leveeing, channelization and petroleum exploration. These activities have led to a reduction in overbank flooding and natural distributary flow which historically provided fresh water, sediments and nutrients to estuarine areas. In addition, construction of large navigation channels has caused progressive intrusion of saline waters. This has resulted in conversion of fresh, intermediate and brackish marshes to intermediate, brackish and saline marshes, respectively, as well as loss of some areas of wooded swamp. Saltwater intrusion and loss of wetlands have adversely affected productivity of wildlife and fishery resources and have led to declines in populations of waterfowl, furbearers and important shellfish and finfish species. Influx of saline waters is particularly harmful to the American oyster, due to increased predation. Juvenile stages of shrimp, menhaden and blue crabs are estuarine-dependent and utilize near-shore estuaries and adjacent wetlands as nursery areas. One way to ameliorate loss of wetland nursery areas and rate of saltwater intrusion is timely introduction of fresh water to provide sediments and nutrients vital to coastal wetlands. Major constraints to freshwater introduction in Louisiana are poor water quality and lower temperatures in the Mississippi River as compared to adjacent estuaries.
W82-02128

EFFECTS OF WETLAND CHANGES ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
D. W. Fruge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 387-398, 1 Fig, 44 Ref.

Descriptors: *Wetlands, *Habitats, *Wildlife, *Diversion, *Estuarine environment, Environmental effects, Sediments, Coastal marshes, Shellfish, Fish, Economic aspects, Estuarine fisheries, *Louisiana.

The vast wetlands of the Louisiana Coastal Region (LCR) are of national importance to fish and wildlife. Prior studies documented an annual land-loss rate of over 16.5 sq mi/yr in the LCR. More recent investigations indicate that this rate of wetland loss more than doubled since 1956. Wetland deterioration, which is partially attributable to natural causes, has been greatly accelerated by human influences such as navigation channel excavation, agricultural drainage, and construction of mainline Mississippi River levees that have prevented freshwater and sediment overflow into adjacent subdelta marshes. Continued wetland deterioration may lead to serious declines in estuarine-dependent fish and shellfish harvest, fur catch, waterfowl habitat, and related fish and wildlife productivity. Preliminary estimates indicate that the monetary value of fish and wildlife productivity can be increased by more than $4.5 million/yr with a single large-scale freshwater diversion structure that would introduce Mississippi River water into the Lake Pontchartrain-Lake Borgne Basin of southeast Louisiana. Because federally financed public works projects have played a major role in wetland deterioration in the LCR, mitigation of these losses through the federal public works program would seem appropriate. (Moore-SRC)
W82-02129

A NEW APPROACH TO DETERMINING THE QUANTITATIVE RELATIONSHIP BETWEEN FISHERY PRODUCTION AND THE FLOW OF FRESH WATER TO ESTUARIES,
National Marine Fisheries Service, Miami, FL. Southeast Fisheries Center.
J. A. Browder, and D. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office, of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 403-430, 2 Fig, 85 Ref.

Descriptors: *Estuaries, *Estuarine fisheries, *Sediment transport, *Detritus, *Nutrients, Environmental effects, Model studies, Salinity, Estuarine environment, River flow, Mixing, Wetlands, Fish, Invertebrates, Microorganisms, Freshwater inflow.

Freshwater inputs to estuaries appear to enhance the production of marine organisms, because the highest standing stocks alon:g shorelines are found in or near estuaries, which receive freshwater inputs. Activities of man that affect the quantity or timing of the flow of fresh water to estuaries include: dams for irrigation and power; diversions; canals in uplands; deforestation; clearcutting; grazing; road construction; and paving. The flow of fresh water into estuaries may influence fishery production, either directly or indirectly, in at least five ways: transport of nutrients; transport of detritus; transport and deposition of sediments; reduction of salinity; and mixing and transport of water masses. Diverse estuarine systems found along the gulf coast from Florida to Texas have similar problems as a result of changes in the quantity and seasonal patterns of the freshwater flow they receive. In a conceptual model, direct river inputs are sediments, nutrients, and fresh water. Sediments build and maintain tidal wetlands, counteracting both natural and anthropogenic processes that destroy wetlands. Nutrients in river water stimulate productivity of wetland vegetation. The physical force of runoff flushes decaying vegetation into tidal creeks and open waters, where it is processed by microorganisms into food for benthic animals, which are fed on by juvenile fish and invertebrates. Nutrients released to open water stimulate productivity of phytoplankton and seagrasses. Freshwater inputs establish chemical potential energy that sometimes drives the mixing of the estuary. (Moore-SRC)
W82-02130

EFFECTS OF FRESHWATER FLOW ON FISHERY RESOURCES IN THE SACRAMENTO-SAN JOAQUIN ESTUARY,
California State Dept. of Fish and Game, Stockton.
P. L. Herrgesell, D. W. Kohlhorst, L. W. Miller, and D. E. Stevens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434,

Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX. Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct.1981, p 71-87. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *River flow, *Fish populations, *Estuaries, *Low flow, *Environmental effects, Water level, Diversion losses, Growth stages, Saline water intrusion, Aquatic habitats, Freshwater inflow, *Sacramento-San Joaquin estuary, California.

The freshwater flows into the Sacramento-San Joaquin Estuary have been declining for many years and are likely to continue to do so. This decline, with the annual variations in flow, affects the fishery resources of the estuary. Diversions from the San Joaquin River are directly responsible for the loss of millions of fish, and are indirectly responsible for the loss of many more because of the effects of flow reversal on fish behavior, and because of the reduction in food supply. Annual abundance indices for striped bass, young fall run chinook salmon, American shad, and longfin smelt show an increase with increases in flow rates during the spawning and early stages of life. High flows increase dispersal of young fish which may decrease density dependent mortality. Overall abundance of opossum shrimp appears to be reduced by salinity-incursion and increased water diversions. Salinity intrusion stimulates dispersal of salt-water species into more of the estuary, while habitat for freshwater species is reduced. Conversely, at the time of high spring runoff the salt-water habitat is reduced. This is thought to be the cause of the movement of juvenile dungeness crab out of the bay. (Brambley-SRC)
W82-02141

VALUES OF ECOLOGICAL CHARACTERIZATION STUDIES TO ASSESS EFFECTS OF FRESHWATER INFLOW TO ESTUARIES,
Fish and Wildlife Service, Slidell, LA.
For primary bibliographic entry see Field 6G.
W82-02147

THE EFFECT OF FOREST CLEARCUTTING IN NEW ENGLAND ON STREAM-WATER CHEMISTRY AND BIOLOGY,
New Hampshire Univ., Durham. Northeastern Forest Experiment Station.
C. W. Martin, D. S. Noel, and C. A. Federer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153627, Price codes: A05 in paper copy, A01 in microfiche. Water Resource Research Center, University of New Hampshire, Research Report 34, July, 1981. 88 p, 13 Fig, 10 Tab, 52 Ref. OWRT-A-051-NH(1), 14-34-0001-8031.

Descriptors: *Clear-cutting, *Environmental effects, *Water quality, *Ecological effects, Algal growth, Invertebrates, Streamflow, *New England, Forest hydrology, Logging, Nutrient cycling, Water pollution, *Watershed management.

Changes in stream chemistry following clearcutting were sought in 56 streams at 15 locations throughout New England. Streams draining clear-cut areas were compared with nearby streams in uncut watersheds over periods of up to 2 years. In general, concentrations of all elements studies (inorganic N, SO4 - S, Cl, Ca, Mg, K, Na), as well as pH and specific conductivity, varied as much among uncut streams at a location as between uncut and cutover streams. However, at most locations, at least one of these variables differed between uncut and cutover streams. The greatest differences occurred with nitrogen in northern hardwood forests in the White Mountains of New Hampshire. At 4 of the locations the effect of cutting on algae and invertebrates in the streams were also examined. Both algal and invertebrate densities were greated in cutover streams by factors of 2 to 4, probably because of increased light and temperature. The taxonomic composition of both algal and invertebrate populations was also changed by cutting. Partial cuts and sufficiently wide buffer strips can minimize both chemical and biological changes.
W82-02178

USE OF HORIZONTAL DRAINS: CASE HISTORIES FROM THE COLORADO DIVISION OF HIGHWAYS,
For primary bibliographic entry see Field 8A.
W82-02211

LONG TERM PERFORMANCE OF HORIZONTAL DRAINS,
For primary bibliographic entry see Field 8A.
W82-02212

MISSISSIPPI'S EXPERIENCE WITH HORIZONTALLY DRILLED DRAINS AND CONDUITS IN SOIL,
For primary bibliographic entry see Field 8A.
W82-02213

ROCKWOOD EMBANKMENT SLIDE BETWEEN STATIONS 2001+00 AND 2018+00: A HORIZONTAL DRAIN CASE HISTORY,
For primary bibliographic entry see Field 8A.
W82-02214

WATER RESOURCES PROTECTION MEASURES IN LAND DEVELOPMENT - A HANDBOOK - REVISED EDITION,
Delaware Univ., Newark. Water Resources Center.
For primary bibliographic entry see Field 4D.
W82-02453

IMPACT OF SUBURBAN RESIDENTIAL DEVELOPMENT ON WATER RESOURCES IN THE AREA OF WINSLOW TOWNSHIP, CAMDEN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
T. V. Fusillo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-124850, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-27, 1981. 38 p, 16 Fig, 7 Tab, 19 Ref.

Descriptors: *Urbanization, *Groundwater, *Water quality, *Surface water, Geohydrology, Urban runoff, Rainfall, Storm runoff, Detention reservoirs, Wastewater treatment, Chemical analysis, Observation wells, Water level, Unit hydrographs, Artificial recharge, Water analysis, *New Jersey, *Camden County, Great Egg Harbor River.

Changes in land use as a result of large-scale residential development can have significant impact on water resources. Data on the quality and quantity of surface water and ground water in the vicinity of the Winslow Crossing residential development, in Winslow Township, New Jersey, were collected from 1972 to 1979. Pumpage for water supply from the Cohansey Sand averaged 0.48 million gallons per day during 1978 and had little effect on water levels in the aquifer. Water quality was variable in the observation wells sampled. High levels of dissolved solids, nitrate-nitrogen, and phosphorus were found in the shallow ground water surrounding the effluent infiltration ponds of a wastewater treatment plant. A treatment process change in 1974 reduced nitrate-nitrogen levels. The development of 14 percent of a 1.64-square-mile drainage area resulted in an increase in the peak discharge of a 60-minute unit hydrograph from approximately 150 cubic feet per second to 270 cubic feet per second. Installation of a stormwater retention basin reduced this peak discharge to 220 cubic feet per second. Streams draining two highly developed drainage areas had significantly higher levels of calcium, magnesium, bicarbonate, and pH than streams draining less developed areas. Winslow Crossing's development had only a slight effect on Great Egg Harbor River in comparison with sources of contamination upstream from the study area. (USGS)
W82-02461

STORMWATER QUALITY PROCESSES FOR THREE LAND-USE AREAS IN BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W82-02469

HYDRAULIC ANALYSIS OF CHENANGO RIVER, BROOME COUNTY, NEW YORK, IN RELATION TO STATE HIGHWAY PLAN,
Geological Survey, Albany, NY. Water Resources Div.
B. Dunn.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $1.50, Microfiche $3.50. Geological Survey Open-File Report 81-1020, 1981. 10 p, 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Flood profiles, *Flood frequency, *Flood recurrence interval, *Bridge design, Hydraulic properties, Flood flow, Flood discharge, Flood forecasting, Planning, *New York, Broome County, Chenango River.

Hydraulic analyses of the 50- and 100-year floods in a 3.2 mile reach of the Chenango River in the towns of Fenton and Chenango in New York were made to determine the effects of two alternative bridge designs on flood levels. Neither design would cause more than a 0.1-foot increase in water level of the 50-year flood nor more than a 0.2-foot increase in water level of the 100-year flood above levels that would occur during these floods under present channel conditions. The discharges used in the analyses were 55,200 cubic feet per second for the 50-year flood and 63,000 cubic feet per second for the 100-year flood. Mean flow velocities and water-surface elevations at 17 cross sections are given for both bridge designs and are compared with those that would occur under present conditions. (USGS)
W82-02477

AQUATIC BIOLOGY OF THE REDWOOD CREEK AND MILL CREEK DRAINAGE BASINS, REDWOOD NATIONAL PARK, HUMBOLDT AND DEL NORTE COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. T. Iwatsubo, and R. C. Averett.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Price codes $15.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-143, May, 1981. 115 p, 10 Fig, 30 Tab, 72 Ref.

Descriptors: *Aquatic life, *Benthic fauna, *Biological properties, *Water sampling, *Pollutant identification, Coliforms, Streams, Sediments, Ecosystems, National parks, Water quality, Water analysis, Hydrologic data, Seston, Phytoplankton, Periphyton, *California, Redwood National Park, Del Norte County, Humboldt County, Redwood Creek, Mill Creek, Logging.

A 2-year study of the aquatic biota in the Redwood Creek and Mill Creek drainage basins of Redwood National Park indicated that the aquatic productivity is low. Densities of coliform bacteria were low except in Prairie Creek, a tributary to Redwood Creek, where a State park, county fish hatchery, grazing land, lumber mill, and scattered residential areas are potential sources of fecal coliform bacteria. Benthic invertebrate data indicated a diverse fauna which varied considerably between streams and among stream sections. Noteworthy findings include: (1) benthic invertebrates rapidly recolonized the streambed following a major storm, and (2) man-caused disruption or sedimentation of the streambed during low flow can result in drastic reductions of the benthic invertebrate community. Seven species of fish representing species typically found in northern California coastal streams were captured during the study. Nonparametric statistical tests indicate that condition factors of steelhead trout were significantly larger at sampling stations with more insolation, regardless of drainage basin land-use history. Periphyton and phytoplankton communities were diverse, variable

in numbers, and dominated by diatoms. Seston concentrations were extremely variable between stations and at each station sampled. The seston is influenced seasonally by aquatic productivity at each station and amount of allochthonous material from the terrestrial ecosystem. Time-series analysis of some seston data indicated larger and sharper peak concentrations being flushed from the logged drainage basin than from the control drainage basin. (USGS)
W82-02484

THE USE OF GEOLOGIC, HYDROLOGIC, AND GEOCHEMICAL MAPPING TECHNIQUES IN ENVIRONMENTAL ASSESSMENT,
For primary bibliographic entry see Field 7C.
W82-02546

4D. Watershed Protection

SANTEE-COOPER REDIVERSION: PROJECTED IMPACTS ON FISHERY RESOURCES AND WILDLIFE HABITATS,
Fish and Wildlife Service, Cookierville, TN.
For primary bibliographic entry see Field 4A.
W82-02168

DERIVING SEDIMENT YIELD PROBABILITIES FOR EVALUATING CONSERVATION PRACTICES,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 2J.
W82-02225

EFFECT OF CORN AND SOYBEAN ROW SPACING ON PLANT CANOPY, EROSION, AND RUNOFF,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2I.
W82-02264

WATER RESOURCES PROTECTION MEASURES IN LAND DEVELOPMENT - A HANDBOOK - REVISED EDITION,
Delaware Univ., Newark. Water Resources Center.
J. T. Tourbier, and R. Westmacott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157967, Price codes: A10 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT TT/81 5, August, 1980. 196 p, 34 Fig. 14-34-0001-8707.

Descriptors: *Handbooks, *Watershed management, *Urbanization, Environmental protection, Land development, *Erosion control, Urban runoff.

This handbook contains descriptions of measures in urban development to prevent, reduce or ameliorate potential problems that would otherwise adversely affect water resources. These problems consist of runoff increases and decreases in infiltration and a greater degree of erosion and sedimentation, flooding, runoff pollution and discharge of sewage effluent. Issues have been analyzed individually in the Christina River Basin and, where possible, quantified. Measures are presented in groups and related directly to the problems listed above. Each group is preceded by a flow chart that relates measures and can aid in the selection of alternative techniques. Each measure is described, and site characteristics to which it is applicable identified. The application, advantages and disadvantages, design criteria and outline specifications, cost guidelines and maintenance, and legal implementation of each measure are individually covered. Illustrated case studies give examples of measures which have been constructed in the field.
W82-02453

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DEVELOPMENT OF IMMUNOENZYMATIC METHODS FOR DETECTION AND QUANTITATION OF POLIOVIRUS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
F. K. Pfaender, and G. K. Whitmyre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153743, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Report No 174, October, 1981. 66 p, 10 Fig, 6 Tab, 190 Ref. OWRT-A-084-NC(1), 14-34-0001-7070.

Descriptors: *Viruses, *Enteroviruses, Shellfish, *Assay, Monitoring, Wastewater, Wastewater treatment, Enteric viruses, Immunoenzymatic assay, Poliovirus, *Pollutant identification, Bacterial analyses, Water analysis, Sediments.

A major problem that must be faced in assessing the microbiological quality of a wide variety of water sources is the identification of human enteric viruses. Monitoring programs based on estimating bacteriological contamination of water are of questionable value in predicting virus concentrations. Routine monitoring of surface, drinking, and recreational waters for virus content is severely hampered by the absence of a reliable, specific, and simple procedure for quantification of the number of virus particles present. This research was directed toward development of a methodology useful for assessing entero-virus contamination. The method is based on an immunoenzymatic assay in which virus specific antibody, to which is bound other antibodies and enzymes, is reacted with the virus. The complex can subsequently be visualized by addition of enzyme reagents which produce a color change in the presence of virus particles. Two forms of this assay have been developed, one using a microscopic visualization of the colored particles and the other based on reactions in a test tube with total color produced being used to quantify virus. Both methods offer promise of being able to count virus particles in moderately contaminated waters. Further development offers the promise of greater sensitivity. (Kiger, NC)
W82-02176

ALGAL-BACTERIAL SYMBIOSIS IN THE CHOWAN RIVER, NC,
North Carolina Univ. at Chapel Hill.
K. K. Gallucci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153669, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1981. 63 p, 19 Fig, 4 Tab. OWRT-B-127-NC(3), 14-34-0001-0274.

Descriptors: *Nitrogen fixing bacteria, *Aquatic bacteria, Nutrients, Blue-green algae, Nuisance algae, Nitrogen fixation, Cycling nutrients, *Radioactive techniques, Bacteria, *Cyanophyta, Amino acids, *Chowan River, North Carolina.

Bacteria from the Chowan River, NC, were counted and isolated during the summer of 1980 and the significant species in the bloom area was identified as Pseudomonas aeruginosa (Schroeter) Migula. When this organism was added to axenic cultures of the blue-green alga Anabaena flosaquae (Lyng.) Breb., the total amount of nitrogen fixed (as determined by acetylene reduction) by the alga was substantially greater than that fixed by axenic controls. A radio-active assay was used to determine the chemotactic response of Pseudomonas aeruginosa to several amino acids, the primary units of blue-green algal nitrogenous exudates. Chemotaxis was observed, to some degree, towards all of the amino acids tested, although the bacterium did not utilize all of them for growth. Thus, in the Chowan River, chemotaxis is the likely mechanism whereby this bacterium detects nutrient-rich microzones along the algal filaments. Other studies have demonstrated that bacteria recycle nutrients in the algal microenvironment and enhance algal nitrogen fixation. Algal-bacterial symbiosis, based on nutrient exchanges, may be a significant factor in the proliferation of blue-green algal nuisance blooms such as those which have appeared on the Chowan River.
W82-02177

DETERMINATION OF DISSOLVED ORGANIC CARBON IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
R. A. van Steenderen, and J. S. Lin.
Analytical Chemistry, Vol 53, No 13, p 2157-2158, November, 1981. 3 Fig, 4 Ref.

Descriptors: *Carbon, *Organic carbon, *Water analysis, Pollutant identification, Dissolved organic carbon, Organic compounds.

A published method for determination of dissolved organic carbon in water by oxidation to CO2 using a silica coil, ultraviolet radiation, and potassium persulfate catalyst has been modified. Optimum effective oxidant conditions for ethylenediamine tetraacetic acid, potassium biphthalate, and valine in water were 0.25% potassium persulfate catalyst and a 3 mm i.d. silica tube 1.8 meters long coiled around a 150 W ultraviolet lamp. Residence time in the coil was 1.5 min. No improvement in oxidation efficiency was produced by increasing digestion temperature, length of silica coil, ultraviolet lamp intensity, or silver or mercury salts as catalysts. Use of excessive acid for removal of inorganic carbon prior to analysis reduced recovey of dissolved organic carbon. (Cassar-FRC)
W82-02194

CONTINUOUS-FLOW INJECTION ANALYSIS OF AQUEOUS ENVIRONMENTAL SAMPLES FOR CHEMICAL OXYGEN DEMAND,
Okayama Univ. (Japan). School of Engineering.
T. Korenaga, and H. Ikatsu.
Analyst, vol 106, No 1263, p 653-662, June, 1981. 8 Fig, 2 Tab, 16 Ref.

Descriptors: *Water analysis, *Chemical oxygen demand, *Wastewater, Oxygen demand, Monitoring, Industrial effluents, Municipal wastes, Domestic wastes, Continuous flow.

A method suitable for measuring chemical oxygen demand in various industrial wastewater samples down to levels of 5 micrograms/liter is presented and compared with results obtained using the Japanese Industrial Standard (JIS) method and conventional manual and automatic methods for the determination of organic pollutants. The method is based on flow injection analysis and uses acidic potassium permanganate solution as both an oxidant and a spectrophotometric reagent, and glucose as a standard. Chemical oxygen demand values for aqueous environmental samples, such as industrial wastewaters, are within an error range of plus or minus 30%. The method is comparable to other manual and automatic methods and has several advantages. A sampling rate of 20 samples per hour can be achieved, and the precision is 0.6%. Chloride ion up to levels of 6000 mg/liter does not interfere, even in the absence of silver salts. The major advantages include the following: the volume of sample used is only 20 microliters, the redox reaction can occur smoothly as the temperature of the reaction manifold can easily be controlled at 100 degrees C, an inexpensive and readily available spectrophotometer can be used for detection of the redox reaction products so that maintenance of apparatus is easily achieved, and the sampling of 20 samples/hr based on the principle of continuous flow injection analysis allows rapid analyses to take place. (Baker-FRC)
W82-02203

DISSOLVED HUMIC SUBSTANCES: A MAJOR SOURCE OF ERROR IN FLUOROMETRIC ANALYSES INVOLVING LAKE WATERS,
Kent State Univ., OH. Dept. of Biological Sciences.
R. E. Carlson, and J. Shapiro.

Limnology and Oceanography, Vol 26, No 4, p 785-790, July, 1981. 3 Fig, 5 Tab, 12 Ref.

Descriptors: *Fluorescence, *Humic acids, *Chlorophyll, Pollutant identification, Organic matter, *Lakes, Errors, Algae, Color.

Dissolved humic substances in fresh waters may be an important source of error in fluorometric analyses such as the in vivo measurement of chlorophyll (Lorenzen, 1966). Fluorescence measurements were taken in lake water samples passed through millipore filters. These tests determined that soluble fluorescence was not a result of: (1) the filter, (2) algal cell breakage, or (3) passage of small particles of chlorophyll through the filter. Water from three lakes, high in dissolved color and low in chlorophyll, had errors of 1.05 to 1.77 per unit of fluorescence. In one case, fluorescence estimated 59 mg per liter chlorophyll where only 5.6 mg per liter was present. A second peak at 730 nm was found in a spectrofluorometric scan of a dried sphagnum peat filtered extract. This peak is probably responsible for the soluble fluorescence found with the in vivo chlorophyll technique. Humic extracts from lake water also fluoresced strongly, the soluble fluorescence decreasing at lower pH. The method may be corrected by subtracting soluble fluorescence from total fluorescence before calculating in vivo chlorophyll or possibly by using an appropriate narrow-spectrum secondary filter. (Cassar-FRC)
W82-02223

COMPOSITE SAMPLING OF HIGHWAY RUNOFF,
Brown and Caldwell, Seattle, WA.
For primary bibliographic entry see Field 7B.
W82-02230

PCBS IN THE HOUSATONIC RIVER: DETERMINATION AND DISTRIBUTION,
Connecticut Agricultural Experiment Station, New Haven.
B. L. Sawhney, C. R. Frink, and W. Glowa.
Journal of Environmental Quality, Vol 10, No 4, p 444-448, October/December, 1981. 3 Fig, 1 Tab, 27 Ref.

Descriptors: *Polychlorinated biphenyls, *Sediments, *Sorption, Fate of pollutants, Pollutant identification, *Housatonic River, Lake Lillinonah, *Connecticut, Chlorinated hydrocarbons, Humic acid, Organic matter, Clays, Aroclors, River beds, Bottom sediments, Organic compounds.

Individual polychlorinated biphenyls (PCBs) were estimated in samples of sediments from the Housatonic River using multiple linear regression of peak heights (or areas) from gas chromatograms. Proportions of Aroclors 1248, 1254, and 1260 were 1.0:0.6:1.9. Analysis of sediments in a 20 km section of the river forming Lake Lillinonah showed high correlation between PCB concentrations and clay and organic matter, suggesting that the primary means of PCB retention and transport is fine particles consisting of clay-organic matter complexes. Concentrations of PCBs in different fractions of one sediment sample were: fine clay size (< 0.2 microns), 9.7 ppm; coarse clay (0.2-2 microns), 4.6 ppm; and silt (2-50 microns), 0.5 ppm. Laboratory sorption experiments with different materials indicated that humic acid adsorbed the most PCBs, followed by river sediment, river sediment with organic matter removed, and clays. Of the clays, illite sorbed the most PCB, kaolinite the least, with vermiculite and montmorillonite, intermediate. (Cassar-FRC)
W82-02255

SEASONAL AND DIURNAL FLUCTUATIONS OF OOMYCETE PROAGULE NUMBERS IN THE FREE WATER OF A FRESHWATER LAKE,
Reading Univ. (England). Plant Science Lab.
For primary bibliographic entry see Field 2H.
W82-02274

PRECONCENTRATION OF PHENYLMERCURY, METHYLMERCURY AND INORGANIC MERCURY FROM NATURAL WATERS WITH DIETHYLAMMONIUM DIETHYLDITHIOCARBAMATE-LOADED POLYURETHANE FOAM,
Eotovs Lorand Univ., Budapest (Hungary). Inst. of Inorganic and Analytical Chemistry.
T. Braun, M. N. Abbas, L. Bakos, and A. Elek.
Analytica Chimica Acta, Vol 131, p 311-314, 1981. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Mercury, *Natural waters, Water analysis, Chemical analysis, Polyurethane foam, Methylmercury, Phenylmercury.

Stable dithiocarbamate-loaded polyurethane foam is easily prepared and allows a very fast extraction of inorganic mercury and organomercurials even from high volumes of solution. These loaded foams are suggested as a universally available preconcentrating sorbent for inorganic mercury (II) ions and also for methyl- and phenyl-mercurials. The diethyldithiocarbamate-loaded foam was prepared by soaking the foam in the appropriate amount of reagent solution to yield a concentration of 30% on the foam. Sulfuric acid or sodium hydroxide was used to adjust the pH to the required values. The sampl solution was percolated through the DDC-foam column at a flow rate of 50 ml/min. Mercury (II) ions were extracted over a wide pH range; the extraction was almost quantitative, even at very low pH values. Due to the very low concentration of mercury in natural waters, preconcentration from sample volumes of 10 liters or more is usually needed. The extraction rate of organomercurials was slower than that of inorganic mercury. Mercury was quite firmly held on the DDC-foam. Less than 0.3% of the total amount retained on the foam was washed out by percolation of 1 liter of water through the column. Inorganic mercury, the organomercurials and the reagent itself were completely eluted from the foam with 100 ml of acetone. (Baker-FRC)
W82-02297

DETERMINATION OF 2,4-DICHLOROPHENOXYACETIC ACID AND SILVEX IN WATER WITH HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Calgon Corp., Pittsburgh, PA.
C. W. Vaughan.
Analytica Chimica Acta, Vol 131, p 307-310, 1981. 2 Tab, 6 Ref.

Descriptors: *Chemical analysis, *Water, Organic compounds, Herbicides, Pesticides, *Drinking water, Chromatography, Measuring instruments, Silvex, 2-4-D, *Pollutant identification.

A method is proposed for the determination of 2,4-D and silvex in drinking water supplies at the microgram/liter level. The method is based on liquid/liquid extraction and high performance liquid chromatography. Sample preparation for water samples is simplified. The ranges of linear response are 50 - 60 nanograms to 60 micrograms for 2,4-D and 30 nanograms to 60 micrograms for silvex. The average recoveries of 2,4-D at the 10 microgram/liter and 1 microgram/liter levels are 91 and 120%, respectively. The average recoveries of silvex at the 10 microgram/liter and 1 microgram/liter levels are 85 and 110%, respectively. This method obviates the need for three steps: filtration of the sample extract through acidified sodium sulfate, esterification of the herbicide acids, and clean-up of the esterified sample extract with a micro-Florisil column. These steps are major contributors to the poor precision of the gas chromatography based method. (Baker-FRC)
W82-02298

DETERMINING MAXIMUM INFLUENT CONCENTRATIONS OF PRIORITY POLLUTANTS FOR TREATMENT PLANTS,
Enviroscience Inc., Minneapolis, MN.
R. M. Anthony, and L. H. Breimburst.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1457-1468, October, 1981. 2 Fig, 10 Tab, 14 Ref.

Descriptors: *Water treatment, *Water quality standards, *Wastewater analysis, *Physicochemical treatment, Sludge disposal, Pollutants, *Pollutant identification, Sludge digestion, Nitrification, Water analysis, Sludge drying, Influent streams, Wastewater treatment, Industrial wastes, Mathematical studies.

A general analytical method used to arrive at maximum influent priority pollutant levels for water treatment plants is described. The priority pollutants present in the collection system should be determined, and available information on industrial processes, industrial waste water analyses, and waste water treatment plant and sludge analyses should be obtained. Limiting concentrations should be studied with respect to inhibition of wastewater and sludge treatment processes, effluent standards and sludge disposal. These concentrations may be determined from past plant data, from data from similar plants, and from state and federal requirements. Analytical methods are given for secondary treatment with sludge digestion and disposal, secondary treatment with nitrification, effluent filtration, sludge digestion and disposal, and physical-chemical treatment with sludge dewatering and disposal. Procedures are outlined for determining the limiting influent concentrations of priority pollutants. Maximum influent priority pollutant concentrations for the facility are recommended based on these limiting influent concentrations. (Geiger-FRC)
W82-02307

EVALUATION OF AUTOMATIC SUSPENDED SOLIDS SAMPLING PROCEDURES,
Tennessee Univ., Knoxville.
G. D. Reed.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1481-1491, October, 1981. 8 Fig, 1 Tab, 9 Ref.

Descriptors: *Suspended solids, *Water sampling, *Wastewater, Wastewater treatment, Sampling, Stokes law, Streamflow, Particle size, Synthetic hydrology, Municipal wastewater, Flow velocity, Sedimentation.

A synthetic waste water solid was devised to test the validity of a suspended solids sampling technique to decide on a representative point for the collection of samples from a wastewater stream. Results showed that as the particle sizes of the solids increased, their rate of recovery at smaller depths decreased within a sampling stream. Since the particle distribution was a function of settling and stream flow velocity, a nearly direct relationship resulted between the recovery of non-filterable solids (NFS) and flow velocities. The inlet to a waste treatment system is not always the best site for collecting a representative sample for solids in a raw wastewater. The hydraulic jump site, which provides a high degree of mixing by natural causes, produced NFS values that were 26% too low. A good sampling point must feature thorough mixing, or else data must be calibrated to reflect true parameter magnitudes. Further investigations are suggested to discover sampling techniques which would be applicable to various type of wastewaters. (Geiger-FRC)
W82-02316

POSITIVELY CHARGED FILTERS FOR VIRUS RECOVERY FROM WASTEWATER TREATMENT PLANT EFFLUENTS,
Wisconsin Univ.-Madison. Dept. of Veterinary Science.
L. T. Chang, S. R. Farrah, and G. Bitton.
Applied and Environmental Microbiology, Vol 42, No 5, p 921-924, November, 1981. 2 Tab, 20 Ref.

Descriptors: *Virus, *Membrane filters, *Wastewater analysis, Pollutant identification, Effluents, Coxsackie virus, Poliovirus, Micro-organisms, Filters.

Enteroviruses from activated sludge effluent were collected on positively charged Zeta Plus membrane filters and eluted with a solution of 4 M urea buffered at pH 9 with 0.05 M lysine. No salt or acid addition was necessary to enhance virus adsorption onto the filters. 40-56% of the poliovirus Type I (LSc) and coxsackievirus B3 added to 19

liters of effluent were recovered and concentrated to final volumes of 1 or 2 ml using flocculation. The economical, efficient, simple method was used on seven effluent samples from two sewage treatment plants. Three types of poliovirus and one coxsackievirus were identified. One sample contained no detectable virus. (Cassar-FRC)
W82-02338

A-1 MEDIUM: ALTERNATIVE TECHNIQUE FOR FECAL COLIFORM ORGANISM ENUMERATION IN CHLORINATED WASTEWATERS,
Wisconsin Univ.-Madison. Lab. of Hygiene.
J. H. Standridge, and J. J. Delfino.
Applied and Environmental Microbiology, Vol 42, No 5, p 918-920, November, 1981. 3 Tab, 8 Ref.

Descriptors: *Most Probable Number tests, *Coliforms, *Wastewater analysis, Pollutant identification, *Bacterial analysis, Microbiological studies, Culture media, Incubation, Chlorination.

The 24-hour Most Probable Number technique, using 3 hours pre-incubation at 35 C and A-1 medium for detecting fecal coliforms in chlorinated wastewater, gave results statistically equivalent to those obtained with the longer two-step Most Probable Number technique described in Standard Methods for the Examination of Water and Wastewater. Tests with a 2-hour preincubation at room temperature (22 C) produced fewer positive tubes (53) than the standard method (62) and the 3 hour, 35 C method (60). (Cassar-FRC)
W82-02339

A CLOSE-INTERVAL SAMPLER FOR COLLECTION OF SEDIMENT PORE WATERS FOR NUTRIENT ANALYSES,
Harbor Branch Foundation, Inc., Ft. Pierce, FL.
J. R. Montgomery, M. T. Price, J. Holt, and C. Zimmermann.
Estuaries, Vol 4, No 1, p 75-77, March, 1981. 2 Fig, 7 Ref.

Descriptors: *Sedimentation, *Sampling, Measuring instruments, Bottom sampling, Acidity, *Pore water, Sulfates, Sulfides, Ammonia, Nutrients, Trace metals, Organic matter, Salinity, Dissolved oxygen, Interstitial water, *Pollutant identification.

This paper describes a single, in situ sampler which simultaneously samples four 1 cm sampling surfaces at 2 cm intervals. This sampler requires minimal sample manipulation, minimizes sediment disturbance, maintains an anaerobic sample environment, and can be used over extended periods of time to sample at one location. The sampler is composed of a tube with a nose cone which facilitates insertion into the sediment. The tube is separated into a layered filter section, a tubular extension to facilitate handling, and a top section which provides the needed connections to the internal sample chambers. Laboratory tests indicate 98 to 100% recoveries for ammonium, silicate, reactive phosphate, nitrate and nitrite. Vertical profiles for ammonium, reactive phosphate and silicate are shown from field studies. Potential applications include analysis of pore waters for trace metals, dissolved organic carbon, sulfides, sulfates, salinity, Eh, dissolved oxygen, and pH. (Baker-FRC)
W82-02346

ENUMERATION OF HETEROTROPHIC BACTERIA IN RIVER WATERS BY USING A LOW NUTRIENT MEDIUM (IN JAPANESE),
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
T. Yoshikura, K. Oda, and S. Iida.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 47, No 2, p 183-189, February, 1981. 6 Fig, 1 Tab, 12 Ref. (English summary).

Descriptors: *Bacteria, *Rivers, Eutrophication, *Nutrients, Culture media, Agars, Microbial analysis, Seasonal variation.

Agar media containing different concentrations of organic nutrients were used to enumerate heterotrophic bacteria in river waters of various degrees of eutrophication. Low nutrient agar medium (0.5 g polypeptone, 0.25 g yeast extract, 0.1 g glucose, and 15 g agar in 1,000 ml distilled water) revealed higher counts of bacteria in any station at any season than did the high nutrient media. This suggests that for recovering heterotrophic bacteria inhabiting river waters the low nutrient medium is superior. Bacteria isolated from less polluted waters were more sensitive to high nutrient concentrations than those from highly polluted waters. This was determined in experiments on the growth response of bacteria to the concentration of organic nutrients. It appeared that the incubation temperature for counting must be selected in accordance with water temperature in the river as the higher counts of bacteria in river waters were obtained at about 35 degrees C in the summer and at about 20 degrees C in the winter. (Baker-FRC)
W82-02352

THE SPECTROPHOTOMETRIC DETERMINATION OF ANTIMONY IN WATER, EFFLUENTS, MARINE PLANTS AND SILICATES,
Liverpool Univ. (England). Dept. of Oceanography.
A. H. Abu-Hilal, and J. P. Riley.
Analytica Chimica Acta, Vol 131, p 175-186, 1981. 3 Fig, 7 Tab, 43 Ref.

Descriptors: *Chemical analysis, *Antimony, Water analysis, Sea water, Effluents, Silicates, Spectrophotometry.

A procedure is developed which concentrates antimony by precipitation with hydrous zirconium oxide prior to solvent extraction and spectrophotometry. The technique has also been applied to the determination of traces of antimony in digesters from marine algae and silicates. After a preliminary oxidative digestion for waters, or acid attack for algae and silicates, the element is quantitatively coprecipitated at pH 5.90 with hydrous zirconium oxide. The precipitate is dissolved in acid and reduced with titanium(III) chloride. Subsequently the antimony is oxidized to antimony (V) with sodium nitrite. The ion pair of the antimony chloride ion with crystal violet is extracted with benzene, and its absorbance is measured at 610 nm. Extraction with toluene causes some loss of sensitivity. The detection limit is 0.005 micrograms/liter. Relative standard deviations are 0.5% and 1.1% for spiked distilled water and sea water, respectively. A wide range of anions and cations caused no interference at levels many times those in natural waters. The technique can be adapted for application to marine algae and silicates. Relative standard deviations were 1.8% and 2% for samples of Pelvetia canaliculata and a Pacific Ocean red clay, respectively. Results for the US Geological Survey Standard rocks GSP1 (2.7 ppm) and DTS1 (0.53 ppm) are in good agreement with those of earlier workers. (Baker-FRC)
W82-02355

DETECTION OF CHLOROFORM IN THE TISSUES OF FRESHLY EVISCERATED POULTRY CARCASSES EXPOSED TO WATER CONTAINING ADDED CHLORINE OR CHLORINE DIOXIDE,
Agricultural Research Council, Norwich (England). Food Research Inst.
D. Robinson, G. C. Mead, and K. A. Barnes.
Bulletin of Environmental Contamination and Toxicology, Vol 27, No 2, p 145-150, 1981. 2 Tab, 10 Ref.

Descriptors: *Chlorination, *Chloroform, *Poultry, Food processing industry, Foods, *Bioassay, Sodium hypochorite, Chlorine dioxide, Chlorine, Industrial water, Water treatment.

The effects of super-chlorinated process water on poultry carcasses were investigated. Concentrations of 5-20 mg/liter free available chlorine may be used for in-plant chlorination of the water of immersion chilling systems. Chlorine is added, usually in the form of sodium hypochlorite, to significantly reduce the bacterial load of the chill-water and to extend the shelf-life of the chill-stored carcasses. Chlorine dioxide was also investigated; it may be used more in the future, as it reduces the formation of trihalomethanes. Twenty-eight chickens were used in the study: five were controls, and batches of three received varying treatments. Birds treated with chlorinated water were tested after cooking for chloroform formation and persistence of chlorine at the point of consumption. The highest concentrations of chlorine occurred in birds immersed in water containing 50 mg/liter of chlorine, especially those held at 15-16 deg C. (Small-FRC)
W82-02374

MODEL EXPERIMENTS ON THE GROWTH OF ENTERIC BACTERIA IN FRESH AND SEA WATER,
Toyama Univ. (Japan).
T. Yanagita, and M. Takagi.
Journal of General and Applied Microbiology, Vol 26, No 4, p 299-305, August, 1980. 4 Fig, 6 Ref.

Descriptors: *Bacteria, *Sea water, *Aquatic environments, *Enteric bacteria, *Experimental design, Oligotrophic lakes, Escherichia coli, Nutrients, Laboratory equipment, Dilution, Salinity, Rivers, Marine bacteria.

The growth of some enteric bacteria with and without added sodium chloride at the concentration of sea water was measured. An apparatus capable of making exponential changes in nutrient and salt concentrations was employed. Growing cultures of E. coli were subjected to nutrient dilutions and to salt solutions over a three week period. Cell densities came to be maintained at a steady-state level preceded by a transitional process related to the changes in environment. This suggests that E. coli cells are able to grow under extreme conditions, though at a restricted rate. (Titus-FRC)
W82-02377

DETERMINATION OF AMMONIA IN ESTUARY,
Tokai Regional Fisheries Research Lab., Tokyo (Japan). Div. of Oceanography.
K. Sasaki, and Y. Sawada.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 3, p 319-321, March, 1980. 6 Fig, 2 Tab, 2 Ref.

Descriptors: *Ammonia, *Estuaries, *Colorimetry, Color, Salts, Detection times, Temperature effects, Seawater, Salinity.

The development of a blue color with indophenol was investigated as a method for the determination of ammonia in estuaries. The effects of temperature and salt concentration on the color development were examined. Reaction temperature influenced the time required for the completion of the color development and the absorbance upon completion. Salt concentration also affected color development and absorbance. Color development at 40 deg C was complete even in seawater and the differences in absorbance was small. In contrast, the salt error was 60 in freshwater and 73 in seawater when the temperature was 20 deg C. The reasons for the effects of temperature and salt concentration are not known. (Small-FRC)
W82-02390

NEW SUPPLEMENTARY DPD PROCEDURES USING SODIUM NITRITE FOR (A) BROMINE-BROMAMINE SEPARATION AND (B) CORRECTION OF CHLORINE DIOXIDE READINGS FOR ANY BROMINE DERIVED FROM NATURAL BROMIDE IN WATERS,
Newcastle and Gateshead Water Co. (England).
A. T. Palin.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 383-385, July, 1980. 1 Tab, 4 Ref.

Descriptors: *Bromine, *Bromamines, *Colorimetry, Disinfection, Trace elements, Nitrite, Chemical reactions, Chlorine, Dilution, Laboratory equipment, Water sampling, Chemical analysis, Residual chlorine, Reagents.

A separate determination of bromine and bromamines may be accomplished by the use of sodium nitrite as a supplementary reagent. Free chlorine, chlorine dioxide, bromine, and bromamines all respond in the first step of the DPD method for determining residual disinfectants in water. With the use of sodium nitrite, the chlorine dioxide readings may also be corrected for any associated traces of free or combined bromine. Following the first step of the normal DPD procedure, addition of sodium nitrite at 50 mg NaNo2/100 ml sample destroyed free bromine without alteration of bromamine readings. However, the presence of nitrite led to fading of the developed colors at the rate of about 4%/min at 20 C. (Titus-FRC)
W82-02394

CADMIUM, COPPER, LEAD, ZINC AND MANGANESE IN THE POLYCHAETE ARENICOLA MARINA FROM SEDIMENTS AROUND THE COAST OF WALES,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
D. M. Packer, M. P. Ireland, and R. J. Wootton.
Environmental Pollution (Series A), Vol 22, No 4, p 309-321, August, 1980. 6 Fig, 2 Tab, 38 Ref.

Descriptors: *Heavy metals, *Polychaetes, *Absorption, Marine animals, Sediments, Coastal waters, *Pollutant identification, Metals, Mine wastes, *Wales, Bristol Channel, Liverpool Bay, Cardigan Bay, Arenicola marina, Cadmium, Zinc, Copper, Lead, Manganese, Estuarine environment.

Metal concentrations in the marine polychaete Arenicola marina and the sediments it inhabits were studied at 24 sites along the coast of Wales, Liverpool Bay (polluted from domestic and industrial outfalls), Cardigan Bay (industry-free, but receiving runoff from former mining operations), and Bristol Channel (domestic and industrial sewage plus minerals from mining wastes). Eight of the sites were estuarine in nature; six of these were located along the Bristol Channel. Highest concentrations (in ppm) in A. marina found were in the upper region of Bristol Channel as follows: Cd, 32; Pb, 90; Zn, 430; and Mn, 320. Highest Cu levels were 40 ppm at Dullas Bay in the north. Mean body weight and mean concentration of individual metals in A. marina were negatively correlated. A positive correlation was seen between concentration of metals in A. marina and sediment for Zn and Cd. Mn was far less concentrated in tissues than in the sediment, Pb was similar in both, Cu and Zn were 2 to 3 times more concentrated, and Cd 11 more times concentrated. (Cassar-FRC)
W82-02416

GROUNDWATER QUALITY IN THE SEVERN-TRENT REGION,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
J. L. Lucas, and R. I. G. Simm.
Water Pollution Control, Vol 80, No 3, p 317-332, 1981. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Groundwater, *Water quality, *Monitoring, Chlorides, Nitrogen, Sulfates, Acidity, Calcium, Magnesium, Sodium, Potassium, Groundwater pollution, Boreholes, Wells, Aquifers, *United Kingdom, Severn-Trent Water Authority.

The Severn-Trent Water Authority's program for monitoring the quality of groundwater is reviewed. The aquifer protection policy is based on the identification of groundwater resource vulnerability in terms of hydrogeology and the classification of practices likely to be unacceptable within each resource risk area. A Groundwater Chemistry Network was established to provide baseline data essential to the understanding of the mechanisms and processes controlling groundwater quality and the establishment of long term trends, to provide a reference against which possible sources of pollution may be revealed, to facilitate full and proper exploitation of groundwater reserves, and to provide data for existing and potential abstractors. Samples from selected sites are taken quarterly and analyzed for temperature, pH, ammonium N, total oxidized nitrogen, chloride, sulfate, alkalinity, total hardness, calcium, magnesium, sodium, potassium, and electrical conductivity. Total organic carbon, fluoride, orthophosphate, and total iron, manganese, cadmium, chromium, copper, lead, nickel, zinc and barium are analyzed annually. The site selections are made in such a manner that they are not immediately adjacent to any obvious potential source of pollution, that the groundwater sample pumped shall be representative of water from a significant volume of the aquifer and not be influenced by chemical changes due to standing for long periods, and that the sample shall be from a borehole or deep well so that as great a thickness of the aquifer as possible is sampled. (Baker-FRC)
W82-02423

DISTRIBUTION ON VIABLE MARINE BACTERIA IN NERITIC SEAWATER AROUND JAPAN,
Tokyo Univ. (Japan). Ocean Research Inst.
K. Kogure, U. Simidu, and N. Taga.
Canadian Journal of Microbiology, Vol 26, No 3, p 318-323, 1980. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Water analysis, *Bacteria, *Bacterial analysis, Measuring instruments, Eutrophication, Temperature effects, Stratification, Sea water, Marine bacteria, Marine plants, Marine biology, Marine environment, *Tokyo Bay.

A new direct viable count (DVC) method has been reported which is aimed at counting the living bacterial cells using a relatively simple procedure for routine work in neritic seawater. This method was applied to various marine samples from environments with different degrees of eutrophication. The temperature and salinity profiles in Tokyo Bay show typical stratification during the summer season. At several stations the particulate organic carbon exceeded the dissolved organic carbon, indicating the continuous input of large amounts of particulate matter from the rivers or abundant growth of various organisms in the seawater. High nutrient concentrations resulted in dense, flourishing phytoplankton populations throughout most of the year in the bay. Almost complete vertical mixing of the water column at one station was due to the proximity of a typhoon just before the day of sampling. The distribution of bacteria reflects the extent of eutrophication in the bay. A gradual decrease in bacterial numbers was noted toward the outer part of the bay. In offshore waters the majority of DVC cells were free-living, and it was very rare to find particles which were heavily colonized with bacterial cells. In Tokyo Bay, however, such particles were often found at several sample stations. They appeared to be freshly produced detrital particles and usually contained degrading algal cells or fibrous structures. These findings suggest that the DVC technique may be used for various aquatic environments as a relatively simple counting technique for living bacteria. (Baker-FRC)
W82-02427

DISTRIBUTION OF RIBONUCLEIC ACID COLIPHAGES IN RAW SEWAGE FROM TREATMENT PLANTS IN JAPAN,
Keio Univ., Tokyo (Japan). Dept. of Molecular Biology.
K. Furuse, A. Ando, S. Osawa, and I. Watanabe.
Applied and Environmental Microbiology, Vol 41, No 5, p 1139-1143, May, 1981. 2 Tab, 11 Ref.

Descriptors: *Wastewater, *Viruses, *Japan, Coliforms, Wastewater composition, Wastewater analysis, *Coliphages, Ribonucleic acid, Feces, Water pollution sources, Microbiological studies, Raw wastewater.

Raw sewage samples were collected from wastewater treatment plants in 16 Japanese cities and analyzed for content of Groups I-IV RNA coliphages. The raw sewage contained human wastes, slaughterhouse wastes, municipal wastewater, and industrial wastewater. Two-milliliter sewage samples were mixed with an equal volume of peptone-glucose medium. Bacteria were killed with chloroform, and the samples were centrifuged. The supernatants were plated onto E. coli strains. The resultant plaques were collected for use as phage stocks and grouped by the serological method. Total coliphage densities were fairly high, ranging from 10 to 1,000,000 plaque-forming units per ml of original phage samples. Group III phages predominated over group II phages. Appreciable amounts of group I phages were also present, suggesting the presence of animal feces in the samples. Reported RNA phage distribution patterns in raw sewage collected from Mexico, Saudi Arabia, Australia, the United States, Brazil, the Philippines, and West Germany followed patterns similar to those for Japan, indicating an absence of special phage-host relationships between RNA phage groups and human races. A complete transmission cycle of group I phages in animals appeared to be present. A similar cycle is possible for the groups II and III phages, but the frequencies of isolation of these phages in human feces appeared to be low. (Carroll-FRC)
W82-02443

ENCHYTRAEID OLIGOCHAETES AS MARINE POLLUTION INDICATORS,
Victoria Univ. (British Columbia). Dept. of Biology.
K. Coates, and D. V. Ellis.
Marine Pollution Bulletin, Vol 11, No 6, p 171-174, June, 1980. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Indicators, *Oligochaetes, *Pollutants, Bioindicators, Marine environment, Industrial wastewater, *Pulp wastes, Feasibility studies, Water pollution effects, Distribution patterns, Estuarine environment.

The possibility of using enchytraeid oligochaetes as indicators of pulp mill pollution in the littoral zone has been investigated as part of a project at the Port Alice (Vancouver Island) pulp mill designed to develop measures for monitoring ecosystem recovery following the application of pollution control procedures. Analyses of sediment core samples from several locations within a pulp mill waste receiving area, including the Cayuse and Cayeghle estuaries, resulted in the identification of 15 species of enchytraeid oligochaetes. One of these, Lumbricillus lineatus, which is a known stress-resistant intertidal form not normally found along the coasts of British Columbia, was found to be predominant within 1.5 kilometers of the pulp mill outfall. Beyond that distance, a variable association of 14 other species from the genera Lumbricillus, Marionina, and Enchytraeus was dominant. L. lineatus has only been collected adjacent to three pulp mills in British Columbia. It was not collected at five other pulp mills or at ten undisturbed intertidal stations where other diverse associations of Enchytraeid species were found. L. lineatus has apparently been introduced to these sites in the Pacific Northwest by international ship traffic. The spatial distribution of L. lineatus close to the mill was found to correspond with oxygen levels reduced well below saturation and with visible but fluctuating levels of mill effluent, indicating that the species has the potential to index the area showing substantial impact of the discharges on the coastal environment. The most practical index is the percentage of total adult enchytraeids, represented L. lineatus. (Carroll-FRC)
W82-02445

BIOASSAYS OF WATERS FROM THE SEVERN AND THAMES RIVER SYSTEMS,
Northwest Water Authority (England).
A. Collie, and J. W. G. Lund.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 2, p 180-188, March, 1980. 1 Fig, 2 Tab, 23 Ref.

Descriptors: *Rivers, *Bioassay, *Bioindicators, *Plankton, Hydrological data, Growth rates, Assay, Algae, Nutrients, Water treatment, Growth kinetics, Aquatic environment, Aquatic organisms, Dilution, Mixing, Flow, Water sampling, *Thames River, *Severn River, England.

A diatom and a green alga were used as test organisms to assess the potential fertility of water from parts of the Severn and Thames Rivers in England. Water samples were taken monthly at a

constant depth and results for the two rivers were compared. Growth rates in the Severn were significantly lower than in the Thames. However, both waters were highly fertile. Results suggest that limitations of algal numbers are due to physical and biological factors rather than chemical ones. A transfer of water from the Severn to the Thames would not significantly alter the algal regime. (Titus-FRC)
W82-02448

WATER-QUALITY RECONNAISSANCE OF THE LARKIN CREEK WATERSHED, LEE AND ST. FRANCIS COUNTIES, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
J. C. Petersen.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Prices: $3.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-819, 1981. 20 p, 1 Fig, 3 Tab, 8 Ref.

Descriptors: *Water quality, *Surface water, *Streams, *Pollutant identification, *Data collections, Streamflow, Water measurement, Water sampling, Bottom sampling, Bottom sediments, Dissolved solids, Bacteria, Nutrients, Metals, Pesticides, Water analysis, *Arkansas, Lee County, St. Francis County, Larkin Creek watershed.

A reconnaissance of the Larkin Creek watershed in Arkansas was made during April through September 1980 to assess the water quality of streams in the watershed. Streamflow was measured and water samples were collected three times during the study period. Samples of bottom material were collected in September. Concentrations of dissolved solids ranged from 45 to 391 milligrams per liter. Water hardness ranged from 31 milligrams per liter (soft) to 280 milligrams per liter (very hard). Fecal-coliform bacteria densities ranged from 40 to an estimated 540 colonies per 100 milliliters and may have exceeded the U.S. Environmental Protection Agency criterion for bathing waters. Total nitrogen concentrations ranged from 0.90 to 2.2 milligrams per liter. Total phosphorus concentrations often exceeded the State standard and ranged from 0.08 to 0.46 milligrams per liter. Low dissolved-oxygen concentrations (2.5 to 5.4 milligrams per liter at midday) were measured in Larkin Creek and a major tributary. Iron (290 to 9,800 micrograms per liter), manganese (60 to 3,100 micrograms per liter), and mercury (0.0 to 0.2 micrograms per liter) concentrations at times exceeded Environmental Protection Agency criteria for domestic use or freshwater aquatic life. High concentrations of toxaphene (20 to 170 micrograms per kilogram dry weight) were present in all bottom-material samples. In two water samples, concentrations of dieldrin (0.01 micrograms per liter) exceeded the Environmental Protection Agency criterion for freshwater aquatic life. Polychlorinated biphenyls, several insecticides, and several herbicides (including 2, 4, 5-T) were present in water or bottom-material samples. (USGS)
W82-02489

COMPARISON OF GROUNDWATER AND SURFACE WATER FOR PATTERNS AND LEVELS OF CONTAMINATION BY TOXIC SUBSTANCES,
Wisconsin Univ.-Milwaukee. Dept. of Urban Planning.
G. W. Page.
Environmental Science and Technology, Vol 15, No 12, p 1475-1481, December, 1981. 1 Fig, 7 Tab, 30 Ref.

Descriptors: *Groundwater pollution, *Chemical wastes, *Surface-groundwater relations, *Toxins, Chlorinated hydrocarbons, Organic compounds, Pesticides, Insecticides, Heavy metals, Metals, Carcinogens, New Jersey, Surface water, Fate of pollutants, Pollutant identification, Water pollution, Drinking water, Wells.

Groundwater is as contaminated with toxic substances as surface water throughout New Jersey. This conclusion is contrary to most of the scientific literature, which indicates that surface waters are more polluted than groundwater, except in isolated cases. Water samples from 1000 wells and 600 surface water sites in areas representing all counties and all types of land use were analyzed for 56 toxic substances: 27 light chlorinated hydrocarbons, 20 heavy chlorinated hydrocarbons, and 9 heavy metals. Comparisons of maximum concentrations show that for 64% of the toxic substances the highest concentration is in groundwater and for 36% the highest concentration is in surface water. The probability of detection was greater in surface water for 54% of the toxics. For 44% there was no significant difference, and for 2% the probability of detection was greater in groundwater. Comparing only those samples with detectable concentrations of the toxic material being tested, 78% of the toxic materials have an average concentration at least as great in groundwater as in surface water. (Cassar-FRC)
W82-02541

CERIOMETRY, A COMBINED METHOD FOR CHEMICAL OXYGEN DEMAND AND DISSOLVED OXYGEN (WITH A DISCUSSION ON THE PRECISION OF THE WINKLER TECHNIQUE),
Station Biologique de la Tour du Valat, Arles (France).
H. L. Golterman, and A. G. Wisselo.
Hydrobiologia, Vol 77, No 1, p 37-42, 1981. 5 Tab, 11 Ref.

Descriptors: *Dissolved oxygen, *Chemical oxygen demand, *Cerium compounds, Winkler method, Pollutant identification, Colorimetry, Oxygen.

A rapid colorimetric method for determination of dissolved oxygen and COD uses Ce(3+) salts and Ce(4+) salts, respectively. This is an improvement over the Winkler method for dissolved oxygen determination, which does not distinguish between oxygen and COD. the interfering organic matter may be treated with Ce(4+) at low or high temperatures, depending on the oxidizability of the substances. The method was tested on oxygen saturated solutions high in COD, using oxalic acid, glycine, polluted lake water, or lake water high in chlorophyll a. The standard deviation is typically 1% of the mean, and accuracy is comparable to that of the Winkler method. (Cassar-FRC)
W82-02562

WATER QUALITY OF A SOUTHEAST TEXAS STREAM,
Lamar Univ., Beaumont, TX. Dept. of Biology.
For primary bibliographic entry see Field 2K.
W82-02570

5B. Sources Of Pollution

ASSESSMENT METHODOLOGIES FOR FRESHWATER INFLOWS TO CHESAPEAKE BAY,
Environmental Protection Agency, Annapolis, MD.
C. J. Klein, O. P. Bricker, D. A. Flemer, T. H. Pheiffer, and J. T. Smullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/004, Vol I, October, 1981, p 185-199, 4 Fig, 9 Ref.

Descriptors: *Estuarine environment, *Model studies, *Water quality, *Nonpoint pollution sources, Runoff rates, Simulation, Nutrients, Land use, Mathematical models, Consumptive use, *Chesapeake Bay, Freshwater inflow.

The EPA Chesapeake Bay program is conducting an in-depth study to assess the principal factors having adverse impacts on the water quality of the bay. The program focuses on the point and nonpoint sources of pollution including nutrients and toxic chemicals that are associated with various land use practices. Water quality data will be evaluated through use of stochastic and deterministic models. Field data collected on specific land uses from five test basins will be the basis for research to verify nonpoint source runoff rates. The field data will be used to calibrate and verify mathematical models in the test basins including nonpoint source loading, stream transport and estuarine processes. In particular, the estuarine models will simulate the impacts of nutrients on water quality. Fall line water quality data will serve as an independent data set to compare the point and nonpoint source projections associated with various land use activities. Mathematical models will be employed on a bay-wide scale to generate nonpoint source loadings basin-wide and to assess the impact from those loading on the tidal bay for the present (1980) and future (2000) conditions. Several growth scenarios that include consumptive freshwater use will be evaluated for their impact on water quality in the bay.
W82-02118

WATER BUDGET AND PROJECTED WATER QUALITY IN PROPOSED MAN-MADE LAKES NEAR ESTUARIES IN THE MARCO ISLAND AREA, FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
W. C. Huber, and P. L. Brezonik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81-04, Vol I, Oct. 1981. p 241-251, 2 Fig, 4 Tab, 11 Ref.

Descriptors: *Hydrologic budget, *Water quality, *Artificial lakes, *Nutrients, Eutrophication, Saline water, Chemocline, Runoff, Phosphorus, Nitrogen, Transparency, Marco Island area, *Florida.

The proposed Marco Island development plan calls for the excavation of a large group of interconnected lakes near Marco Island, Florida. The quality of the proposed lakes is of considerable importance, both to the riparian owners and to the nearby estuarine areas that will receive surface discharges. The deep lakes will be stratified due to the influx of hypersaline ground water below a depth of 2.0 m. Density differences are so great across the chemocline that the possibility of overturn is nil. The lakes receive water from surface runoff from the various land uses; from inflow, from regional ground water flow in the shallow fresh water layer, and from direct rainfall. Water is lost by surface runoff, ground water outflows and evaporation. Annual precipitation in the area is about 50 inches. Residence times of 0.42 and 0.65 years have been calculated for two units of the development. On the basis of phosphorus loading rates, the lakes are expected to be mesotrophic with fair to good water quality. On the whole, predicted water quality is good with Secchi disk transparencies on the order of 1.2 to 1.5 m, and total nitrogen of about 1.3 mg/l. On the basis of nutrient loads, the urban development is expected to have little impact on the estuaries. (Moore-SRC)
W82-02122

TRIHALOMETHANE FORMATION IN NORTH CAROLINA DRINKING WATERS,
North Carolina Univ. at Chapel Hill. School of Public Health.
P. C. Singer, J. J. Barry, G. M. Palen, and A. E. Scrivner.
Journal of the American Water Works Association, Vol 73, No 8, p 392-401, August, 1981. 9 Fig, 9 Tab, 17 Ref.

Descriptors: *Potable water, *Trihalomethanes, Water pollution sources, Chlorination, Filtration, Water treatment facilities, Drinking water, Chlorine, Chloroform, *North Carolina.

A two year research project was initiated in September 1978 to assess trihalomethane (THM) formation in North Carolina drinking waters. The objectives of the study were: to analyze the quality

of raw and treated water at major water treatment facilities in North Carolina: to analyze data collected at these facilities by comparing THM concentrations with the 100 microg/liter standard, with organic carbon content, and with other physical and chemical water quality and treatment parameters to ascertain significant correlations between these parameters and THM formation: to perform laboratory treatability studies of methods for reducing and controlling THM formation at facilities not in compliance with the maximum contaminant level: and to use the results of the bench scale studies to recommend plant scale modifications to bring these plants into compliance. It was concluded that THMs were formed during the water treatment process at all locations. The average concentration in finished waters was 72 microg/liter and the median concentration was 58 microg/liter. Chloroform was the most predominant species. Raw water total organic carbon (TOC) and seven day chlorine demand correlated well with the THM formation potential of raw water and seemed useful as indicators of the THM concentration in finished water. THM concentrations increased during the course of treatment. Coagulation and settling and filtration reduced terminal THM concentrations an average of 42% and 54%, respectively. Both seasonal and temperature variations in THM formation were noted. A geographic distribution of THM formation and raw water TOC was noted. Elimination of prechlorination and applying chlorine during post-sedimentation or post-filtration reduced THM formation significantly. (Baker-FRC)
W82-02195

ENVIRONMENTAL CONTROL TECHNOLOGY DEVELOPMENT FOR GEOTHERMAL ENERGY,
Department of Energy, Oakland, CA. Geothermal Energy Div.
For primary bibliographic entry see Field 5C.
W82-02197

FATE OF DIFLUBENZURON IN WATER,
Science and Education Administration, College Station, TX. Veterinary Toxicology and Entomology Research Lab.
G. W. Ivie, D. L. Bull, and J. A. Veech.
Journal of Agricultural and Food Chemistry, Vol 28, No 2, p 330-337, 1980. 1 Fig, 5 Tab, 29 Ref.

Descriptors: *Diflubenzuron, *Insect control, *Insecticides, *Degradation, Fate of pollutants, Dimilin, Pesticides, Natural waters, Hydrogen ion concentration.

The insect growth regulator, diflubenzuron (Dimilin), at a concentration of 0.1 ppm had a half life of 7 days in distilled water (pH 6), and less than 3 days at pH 10.0; no degradation was observed even after 56 days at pH 4.0. Major degradation products were (4-chlorophenyl) urea and 2,6-difluorobenzoic acid, with small amounts of 2,6-difluorobenzamide and the quinazolinedione product. The use of diflubenzuron as an insect control agent should should not result in persistent residues in natural waters unless the water is quite acid. (Cassar-FRC)
W82-02216

TRANSPORT AND FATE OF SELECTED ORGANIC POLLUTANTS IN A SANDY SOIL,
Environmental Protection Agency, Ada, OK.
J. T. Wilson, C. G. Enfield, W. J. Dunlap, R. L. Cosby, and D. A. Foster.
Journal of Environmental Quality, Vol 10, No 4, p 501-506, October/December, 1981. 3 Fig, 4 Tab, 34 Ref.

Descriptors: *Chlorinated hydrocarbons, *Organic compounds, Fate of pollutants, Adsorption, Biodegradation, Degradation, Chloroform, Hydrocarbons, Solute transport, Path of pollutants, Organic matter, Sandy soils, *Groundwater pollution.

Organic compounds, chosen to represent serious groundwater pollutants, were applied to glass columns containing sandy soil profiles (low organic C, 0.087%). Water containing 1.0 or 0.2 mg per liter of the organic compound was applied at the rate of 14 cm per day for 45 days. Concentrations of compounds in the effluents and the amounts volatilized were determined and the mass balances calculated. Chemicals which percolated rapidly through the soil without degradation were chloroform, 1,2-dibromo-3-chloropropane, dichlorobromomethane, 1,2-dichloroethane, tetrachloroethene, 1,1,2-trichloroethane, and trichloroethene; retardation factors (velocity of tritiated water through the soil divided by the apparent velocity of pollutant through soil) were 2.5 or less. Little or no biodegradation was observed. From 19 to 65% of chemical applied to the surface reached the 140 cm depth, and the rest volatilized. Retardation of chlorinated benzenes generally increased with decreasing water solubility. Some degradation occurred in this group of compounds. Bis(2-chloroethyl) ether did not degrade, and its retardation factor was < 1.5. A method was developed to predict the retardation factors on the basis of water solubility of the chemical and soil organic C content. Soils containing low organic matter are more pollution-vulnerable. (Cassar-FRC)
W82-02220

PATHWAYS AND MECHANISMS FOR REMOVAL OF DISSOLVED ORGANIC CARBON FROM LEAF LEACHATE IN STREAMS,
Oregon State Univ., Corvallis. School of Oceanography.
C. N. Dahm.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 1, p 68-76, January, 1981. 4 Fig, 2 Tab, 50 Ref.

Descriptors: *Organic carbon, *Microbial degradation, *Adsorption, Organic matter, Clays, Iron oxide, Aluminum oxide, Leaves, Alder, Streams, Sediments, Degradation.

Leachate from alder (Alnus rubra) leaves was used to measure the removal of dissolved organic carbon (DOC) by adsorption and by microbial uptake. Over a 48-hour period 97% of added C14 labeled leachate was removed, 20% by adsorption and 77% by microbial utilization. Only a specific fraction of the DOC, probably containing specific chemical groups, was adsorbed. At pH 7 montmorillonite was the most adsorbent of the clay materials tested (0.8% of available DOC), followed by chlorite, 0.6%, and kaolinite, 0.5%. Fine detritus, thought to consist of uncrystallized aluminosilicate clays and hydrous oxides of Fe and Al, adsorbed 7.9 to 27.4%. Hydrous Al oxide alone removed 33% of the DOC, hydrous iron oxide, 26%, and montmorillonite clay prefused with amorphous iron, 26%. Adsorption by the organic fraction of the sediment was measured by treating leachate in chambers unpoisoned, poisoned with $HgCl_2$, and poisoned plus oxidation of organic matter. After 2 hours the DOC removals were 34, 25, and 21%, respectively. Although microbial uptake of DOC was kinetically slower (14 mg C per sq meter per hour), than adsorptive uptake, it was more effective over a longer period. (Cassar-FRC)
W82-02222

BIODEGRADABILITY STUDIES WITH ORGANIC PRIORITY POLLUTANT COMPOUNDS,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5D.
W82-02231

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,
Queens Unit., Kingston (Ontario). Dept. of Geography.
E. D. Ongley, M. C. Bynoe, and J. B. Percival.
Canadian Journal of Earth Sciences, Vol 18, No 8, p 1365-1379, August, 1981. 9 Fig, 1 Tab, 65 Ref.

Descriptors: *Storm runoff, *Suspended solids, *Nutrients, Rural areas, Catchment areas, Seasonal variations, Metals, Particle size, Path of pollutants, *Wilton Creek, *Ontario.

Spatial and seasonal characteristics of suspended solids, phosphorus, and heavy metal associations were quantified in a study of stormflow events in a representative rural nonpoint source catchment of southeastern Ontario. The purpose of the study was to learn more about the principles of nutrient and contaminant transport in relatively uncontaminated fluvial systems. Field portable continuous flow centrifuge apparatus was used to collect bulk samples of subsieve solids. No significant spatial difference in physical or chemical properties of suspended solids was found between the four sample sites, which were located 1500-2000 m apart. There were profound seasonal shifts relating to hydrodynamic and biological factors. Particle-size distributions changed systematically throughout the year. Concentrations of P, Ca, and Mn increased in summer, while Al, Ti, Fe, and K peaked early in the year. (Small-FRC)
W82-02236

STREAM PHOSPHORUS EXPORTS FROM WATERSHEDS WITH CONTRASTING LAND USES IN SOUTHERN ONTARIO,
York Univ., Downsview (Ontario). Dept. of Geography.
A. R. Hill.
Water Resources Bulletin, Vol 17, No 4, p 627-634, August, 1981. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Phosphorus, *Land use, *Watersheds, Rivers, Agriculture, Topography, Wastewater, Environmental effects, Water quality, Duffin Creek basin, *Ontario.

Factors were analyzed which influence the concentration and loss of phosphorus from 22 watersheds within the Duffin Creek drainage basin. The roles of agriculture and urban land use were considered, as well as the influence of soil type and topographical characteristics. Over the 25 month period of the study, the annual average loss varied from 0.027 to 2.11 kg P/ha. Effluent from a sewage treatment plant contributed about 68% of the annual input of dissolved molybdate reactive phosphorus. There were also strong correlations with phosphorus content and crop areas and negative correlations with forests, abandoned farmland, and sandy loam soils. There was considerable retention of phosphorus in the stream channel, particularly during low summer flows. (Small-FRC)
W82-02251

PCBS IN THE HOUSATONIC RIVER: DETERMINATION AND DISTRIBUTION,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5A.
W82-02255

MAJOR- AND TRACE-ELEMENT COMPOSITION OF SUSPENDED MATTER IN THE NORTH-EAST GULF OF ALASKA: RELATIONSHIPS WITH MAJOR SOURCES,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, and G. J. Massoth.
Marine Chemistry, Vol 10, No 5, p 431-453, 1981. 4 Fig, 6 Tab, 49 Ref.

Descriptors: *Suspended load, *Gulfs, *Gulf of Alaska, *Alaska, *Water pollution sources, Trace elements, Chemical analysis, Water analysis, Water currents, Copper River, Rivers, Streamflow, Aluminum, Copper, Calcium, Potassium, Manganese, Iron, Nickel, Zinc, Silicon, Calcium, Carbon, Nitrogen, Seasonal variation.

The spatial and temporal variations of major and trace elements associated with suspended matter from the north-east Gulf of Alaska are described with a view to understanding their relation to major sources. The north-east Gulf of Alaska is bordered by a mountainous coastline containing numerous glaciers, rivers, and streams which deliver large quantities of suspended material to the Gulf during the summer months when maximum discharge occurs. The major sediment dicharge is from the Copper River. Coastal circulation in the

gulf is dominated by the westward-flowing Alaska Current, which generally parallels the coastline. Particulate matter samples were collected from 51 stations in the north-east Gulf during each of three cruises. The results showed that suspended material from the Copper River and coastal streams was carried westward along the coast and deposited in nearshore environments. However, near Kayak Island, significant quantities of suspended material of terrestrial oigin were deflected to the southwest, past the edge of the outer shelf, by an anticyclonic gyre. The distribution patterns of the major and trace elements in the particulate matter and their elemental ratios with aluminum indicated that K, Ti, Mn, and Fe were primarily associated with aluminosilicate material, C and N with organic material, and Si, Ca, Cr, Ni, Cu and Zn with aluminosilicate material in near-shore surface and near-bottom samples and with organic material in offshore surface samples. Only C, N, Ca, Cu, and Zn showed significant seasonal variations which appeared related to biological production of organic matter. (Baker-FRC)
W82-02259

INCREASES IN SODIUM AND CHLORIDE IN THE MOHAWK RIVER, NEW YORK, FROM THE 1950'S TO THE 1970'S ATTRIBUTED TO ROAD SALT,
Geological Survey, Albany, NY.
N. E. Peters, and J. T. Turk.
Water Resources Bulletin, Vol 17, No 4, p 586-598, August, 1981. 2 Fig, 6 Tab, 31 Ref.

Descriptors: *Sodium, *Chloride, *Deicers, Rivers, Water quality, *Water pollution sources, Salts, Ions, Chemical content, Mohawk River, New York, Roads, Road deicers.

A study to relate the chemical quality of the Mohawk River in 1951-53 and 1970-74 to chemical weathering rates within the basin was performed, using regression analysis of major ion concentrations. Sodium and chloride had consistently higher yields in kg/sq km/yr than other ions, although there was a 20% increase in all ions. The general increase in ion content was attributed to accelerated transport of ions out of the basin because of a 19% increase in stream discharge. Analysis of sources of sodium and chloride indicated that rock salt used as a deicer on roads may be a primary source. Transport rates of these chemicals have increased by 72% for sodium and 145% for chloride over the two decades studied. Forty percent of the sodium and 41% of the chloride was judged to result from rock salt use. Other major sources included natural weathering, domestic sewage, and atmospheric precipitation. (Small-FRC)
W82-02262

NUTRIENT AND SEDIMENT LOADINGS FROM A SUBSURFACE DRAINAGE SYSTEM,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
A. B. Bottcher, E. J. Monke, and L. F. Huggins.
Transactions of the ASAE, Vol 24, No 5, p 1221-1226, September/October, 1981. 9 Fig, 4 Tab, 4 Ref.

Descriptors: Sediment load, *Subsurface drainage, Drainage, Groundwater movement, *Sediment transport, Drains, Water quality, *Nutrients, Sediments, Path of pollutants.

The overall water quality impact associated with the waters discharged from a subsurface drainage system on a field with minimum surface runoff was determined. The drainage system was installed in the early 1950's at a depth of 1 to 2 meters. The drain lines are clay tile with topsoil blinding except under observed wet spots, where stone envelopes exist. The system outlet was monitored for flow and water quality parameters using automatic sampling and recording equipment. Flow was determined by recording the depth of water behind a weir crest with a bubble-tube stage recorder. The majority of the subsurface drainage from the field occurred as the result of the winter moisture accumulation. Hydraulic conductivity of a soil profile might be increased by long term good soil management including subsurface drainage. Over 70% of the nitrogen lost in the drainage water was in nitrate form. About 70% of the phosphorus losses were in the form of sediment-bound phosphorus. Sediment, sediment-bound phosphorus and pesticides were all able to move through the soil profile, indicating the presence of direct flow channels. Heavy rainfalls occurring shortly after fertilizer application can greatly increase losses of both nitrogen and phosphorus through a subsurface drainage system. Better fertilization management can reduce the amount of soluble nutrients reaching tile drains. (Baker-FRC)
W82-02266

CHEMICAL AVAILABILITY OF CADMIUM IN MISSISSIPPI RIVER SEDIMENT,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
R. A. Khalid, R. P. Gambrell, and W. H. Patrick, Jr.
Journal of Environmental Quality, Vol 10, No 4, p 523-528, October/December, 1981. 4 Fig, 2 Tab, 35 Ref.

Descriptors: *Cadmium, *Oxidation-reduction potential, *Hydrogen ion concentration, *Dredging, *Sediments, Fate of pollutants, Water pollution sources, *Mississippi River, Chelation, Chemical reactions, Food chains, Organic matter, Sulfides.

The distribution of Cd among various chemical forms (water-soluble, exchangeable, reducible, DTPA-extractable or chelated, and insoluble organic-bound) at different pH and redox potentials (Eh) were studied in the laboratory using Mississippi River sediments. The sediment suspensions, spiked with 0.2 micro Ci Cd109 per g solids, were incubated at 4 redox poential levels from strongly reduced to well-oxidized (-150, +50, +250, and +500 mV) at each of 3 pH levels (5.0, 6.5, and 8.9). Water soluble Cd109 generally increased with pH decreases, especially in the +250 and +500 treatments, and was little changed by Eh changes at neutral or alkaline pH. Exchangeable Cd109 levels increased with Eh from 2.0 to 57.5% at pH 5.0 and from 1.3 to 20.6% at pH 6.5. At pH 8.0 the Cd109 varied from 1.5 to 3.5%. The reducible fraction (adsorbed on Fe/Mn hydrous oxides) ranged from 6.4 to 21.6% of added Cd109 and was not significantly affected by pH or Eh changes. Cd109 levels in the chelated fraction were 12.9-18.2% at pH 8.0, 10.8-23.6% at pH 6.5, increasing with Eh, and 10.9-20.6% at pH 5.0, showing no trend. Insoluble organic bound Cd109 was highest at strongly reduced sediment conditions and decreased with increased oxidation at all pH levels. Disposal of dredged material containing Cd in open water would not release much Cd to the water under the typical very reduced, alkaline to neutral conditions. However, Cd could be readily mobilized from dredged material dumped on land high in organic matter or sulfides. Reduced sulfide-rich sediments exposed to air oxidize to sulfuric acid, producing pH levels as low as 2 to 4, and releasing Cd to runoff, groundwater, and the food chain. (Cassar-FRC)
W82-02267

NITRATE-NITROGEN IN TILE DRAINAGE AS AFFECTED BY FERTILIZATION,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and H. P. Johnson.
Journal of Environmental Quality, Vol 10, No 4, p 519-522, October/December, 1981. 2 Fig, 3 Tab, 24 Ref.

Descriptors: *Fertilizers, *Nitrates, *Tile drainage, Nutrients, Nitrogen compounds, Corn, Soybeans, Oats, Agriculture, Drainage effects, Leaching, Water quality, Water pollution sources, Fate of pollutants, Agricultural runoff.

Tile-drained corn fields in Iowa lost significant nitrate-N to streamflows under moderate and high fertilizer applications. In a before and after study, the two plots, grown to corn in rotation with oats or soybeans, received 112 kg N per ha in 1970 and again in 1972 (first phase). In the second phase one plot received 100 kg N per ha in 1974 and 90 kg per ha in 1976; the second plot, 250 kg per ha in 1974 and 240 kg per ha in 1976. In 1978 both plots were fertilized with 90 kg N per ha. Nitrate-N levels in drainage water samples from the higher fertility plot exceeded those from the lower fertility plot by two fold in 1974 and four fold in 1976. There was a 2-month lag after fertilizer application before the excess N appeared in the tile drainage water. Even 3 years after the last differential fertilizer application the higher fertility plot was contributing more N to drainage waters than the lower fertility plot. The low fertility plot drainage water averaged concentrations of 20 micrograms per ml for a total loss of 27 kg N per ha; the higher fertility plot, 40 micrograms per ml concentration and 48 kg N per ha total loss. Heavy rains caused temporary high concentrations (up to 92 micrograms per ml) of nitrate-N in drainage waters. (Cassar-FRC)
W82-02269

CONTINUOUS SIMULATION OF RECEIVING WATER QUALITY TRANSIENTS,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
M. A. Medina, Jr., and J. Buzun.
Water Resources Bulletin, Vol 17, No 4, p 549-557, August, 1981. 10 Fig, 2 Tab, 19 Ref.

Descriptors: *Mathematical models, *Urban runoff, *Biochemical oxygen demand, *Dissolved oxygen, Runoff, *Water quality, Storm water, Water pollution sources.

A continuous simulation model was derived which solves the one-dimensional transient conservation of mass equations for coupled biochemical oxygen demand-dissolved oxygen reactions for urban stormwater runoff. The solution is based on the principle of superposition for continuously discharging plane sources. The model permits the derivation of water quality frequency curves and frequency histograms of consecutive hourly dissolved oxygen violations at any set standard. The scheme is applied to the Des Moines River to determine the urban storm impacts of Des Moines, Iowa. Urban stormwater impacts can be masked by the cumulative frequency curve representation, but the frequency histograms clearly showed the duration of consecutive water quality standard violations. The application also revealed the inadequacy of fixed magnitude water quality standards. Most waste allocation studies are based on arbitrary (7-day, 10-year low flow) conditions, and the probability of occurrence cannot be established. (Small-FRC)
W82-02271

THE SUSPENDED SEDIMENT-WATER PARTITIONING COEFFICIENT FOR KEPONE IN THE JAMES RIVER, VIRGINIA,
William and Mary Coll., Gloucester Point, VA. Inst. of Marine Science.
C. J. Strobel, R. E. Croonenberghs, and R. J. Huggett.
Environmental Pollution, Series B, Vol 2, No 5, p 367-372, 1981. 1 Fig, 4 Tab, 9 Ref.

Descriptors: *Suspended sediments, Rivers, *Kepone, *James River, Pesticides, Pollutants, Contamination, Storm surges, Storm tides, Waves, Water pollution control, Monitoring, Virginia.

Attempts were made to verify, in the field, laboratory estimates of the suspended sediment-water partitioning coefficient for Kepone. Attempts were also made to determine the effect of tropical storm David on this value. Surface water samples were collected on September 4, 6, and 12 at three stations on the James River, Virginia. Two samples were obtained from each station on each sampling date at about 1 hr before low tide. No significant differences in calculated partitioning coefficients were found between stations or between dates. The concentration of Kepone dissolved in the water was not significantly different before and after storm David. Salinity decreased after the storm and remained depressed for at least a week. The concentration of suspended sediment in the water increased significantly after the storm at two stations and decreased at the third. The three stations chosen for the study represent different degrees of

sediment loading. The rapid equilibration of Kepone between water and suspended sediment suggests that the major impact on Kepone movement from a storm might lie in the physical movement of sediments and water, without changes in their respective Kepone concentrations. (Baker-FRC)
W82-02284

NITRATE AND AMMONIA UPTAKE IN THE APEX OF THE NEW YORK BIGHT,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
For primary bibliographic entry see Field 5C.
W82-02286

HEAVY METALS IN RIVER SEDIMENTS - CALCULATION OF METAL ADSORPTION MAXIMA USING LANGMUIR AND FREUNDLICH ISOTHERMS,
Shefield Univ. (England). Dept. of Microbiology.
J. E. Duddridge, and M. Wainwright.
Environmental Pollution, Series B, Vol 2, No 5, p 387-397, 1981. 6 Tab, 14 Ref.

Descriptors: *Sediments, *Heavy metals, Metals, Rivers, Adsorption, Isotherms, Chemical analysis, England, Path of pollutants, *Bottom sediments.

The use of various extractants to determine the concentrations of biologically available heavy metals in diverse river sediments is reported. Whether heavy metal adsorption to these sediments can be adequately described using Langmuir and Freundlich isotherms was also investigated. Four English rivers, the Lathkill, Wye, Swale and the Porter Brook, were chosen for the study. At each site several river sediment cores were collected randomly at a water depth of more than 0.5 meters. River water samples were also collected. The pH of the sediments was near neutrality, ranging from pH 6.8 for the River Swale to pH 7.4 for the River Wye. The top 1.5 cm of sediments were oxidizing. The particle size distribution of the sediments showed that the River Swale and Porter Brook sediments were predominantly sandy in texture. The River Lathkill and River Sye sediments tended toward a silt and clay texture, reflecting the superficial deposits over which they flow. A relatively low concentration of metal was found in the river water samples, compared to the sediment samples. Less than 10% of the total metal concentration was extractable by extractants used to predict plant uptake of these elements from soils. The most effective extractant was EDTA, followed by ammonium acetate, while distilled water proved inefficient. In the majority of cases the adsorption of heavy metals to the sediments fitted the Langmuir isotherm or, where they did not, the results fitted a Freundlich isotherm. (Baker-FRC)
W82-02290

THE EARLY DIAGENESIS OF ALIPHATIC HYDROCARBONS AND ORGANIC MATTER IN SEDIMENTARY PARTICULATES FROM DABOB BAY, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
F. G. Prahl, J. T. Bennett, and R. Carpenter.
Geochimica et Cosmochimica Acta, Vol 44, No 12, p 1967-1976, 1980. 3 Fig, 3 Tab, 37 Ref.

Descriptors: *Sediments, *Hydrocarbons, Aliphatic hydrocarbons, *Dabob Bay, *Washington, Estuarine environment, *Estuaries, Sediment-water interfaces, Interfaces, Plankton.

Results are presented of analyses of aliphatic hydrocarbon compositions and bulk organic matter in sediment trap-collected particulate material and bottom sediments from Dabob Bay, Washington. High resolution glass capillary gas chromatography was used in the analysis. A comparison was made between the average net accumulation of individual hydrocarbons measured in a 1 year series of sediment traps and the net accumulation of corresponding compounds measured in three depth intervals of Pb-210 dated bottom samples. The net accumulation of individual hydrocarbons registered systematic and rapid decreases from the sediment traps to the seidments. The most pronounced decreases were noted for planktonically derived hydrocarbon constitutents such as pristane and two unsaturated compounds which were rapidly remineralized at or near the sediment-water interface. It was concluded that the amount of each compound as measured in deposited sediments is not necessarily a quantitative indication of its initial flux to the sediments. The hydrocarbons of terrestrial plant wax origin were the predominant ones measured by the 4-6 cm depth in these sediments, and they demonstrated a reasonably constnat net accumulation below this interval. Diagenetic alteration of the bulk organic matter contained in the average sediment trap particulate material was noted through comparison with bottom sediments. Organic matter elementally similar to marine plankton was preferentially remineralized on deposition of the sedimentary particulates. The organic matter remaining and buried in the bottom sediments closely resembled terrestrial organic matter. (Baker-FRC)
W82-02310

INTERNATIONAL CONFERENCE ON THE EFFECTS OF ACID RAIN URGES MORE RESEARCH IN CRITICAL AREAS,
Swedish Natural Science Research Council, Stockholm.
For primary bibliographic entry see Field 5C.
W82-02311

VIRAL TRANSPORT TO GROUND WATER AT A WASTEWATER LAND APPLICATION SITE,
Texas Univ. at San Antonio.
For primary bibliographic entry see Field 3C.
W82-02317

PERMETHRIN CONCENTRATION ON COTTON PLANTS, PERSISTENCE IN SOIL, AND LOSS IN RUNOFF,
Science and Education Administration, Baton Rouge, LA.
B. R. Carroll, G. H. Willis, and J. B. Graves.
Journal of Environmental Quality, Vol 10, No 4, p 497-500, October/December, 1981. 4 Tab, 14 Ref.

Descriptors: *Insecticides, *Permethrin, *Runoff, Fate of pollutants, Pesticide residues, Cotton, Degradation, Agricultural runoff.

The synthetic pyrethroid insecticide permethrin, applied to cotton plants at the rate of 0.112 kg per ha on 10 days during August and September 1976 and 1977, did not appear in runoff in concentrations of more than 0.20 ppg in 1976. However, in 1977, a high rainfall year, 3 of 28 runoff samples contained over the 0.39 ppb LC50 value for crawfish (3.5, 1.9, and 0.44 ppb). Most other samples collected in 1977 remained below the 1 ppb level. Analysis of cis and trans isomers on plants and leaf litter and in soil and runoff indicated that permethrin disappeared within 3-6 months after the last application. Although the ratio of cis to trans isomer was near unity in the applied insecticide and on the plants and leaf litter, there was a higher proportion of cis isomer in the soil. Even under severe runoff conditions, permethrin is not likely to be harmful to aquatic species. (Cassar-FRC)
W82-02322

COMPARATIVE UPTAKE OF ACTINIDES BY PLANTS AND RATS FROM THE SHORELINE OF A RADIOACTIVE POND,
Oak Ridge National Lab., TN. Environmental Science Div.
C. T. Garten, Jr.
Journal of Environmental Quality, Vol 10, No 4, p 487-491, October/December, 1981. 4 Tab, 22 Ref.

Descriptors: *Radioactive wastes, *Bioaccumulation, *Food chains, Plutonium, Americium, Uranium, Curium, *Fate of pollutants, Aquatic plants, Rats, Accumulation, Sediments.

Relative uptakes of actinides by plants and rats from the shoreline of a former low-level liquid radioactive waste pond were Pu < Am < or = Cm < U233 = U238. Analyses of emergent macrophytes (Eliocharis and others), rat carcasses and gastrointestinal tracts, and shoreline sediments indicated that shoreline plants contained 2-150 times the actinide concentrations of fescue collected at the top of the bank. The ranges of actinide levels (in fCi per g dry weight) were: plants, 4.1-1311; rat carcasses, 1.2-71; rat gastrointestinal tracts, 18-35510; and shoreline sediment, 4100-869,400. From a comparison of plant/sediment, rat carcass/sediment, and rat carcass/plant concentration ratios, the relative uptakes listed above were inferred. Sediment leachability studies and patterns of uptake by plants and rats indicate that the valence states of the actinides at this site are Pu(4+), Am(3+), Cm(3+), and U(6+). (Cassar-FRC)
W82-02323

SPATIAL AND TEMPORAL VARIATION OF FECAL COLIFORM MOVEMENT SURROUNDING SEPTIC TANK-SOIL ABSORPTION SYSTEMS IN TWO ATLANTIC COASTAL PLAIN SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
L. W. Stewart, and R. B. Reneau, Jr.
Journal of Environmental Quality, Vol 10, No 4, p 528-531, October/December, 1981. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Septic tanks, *Soil absorption capacity, *Water table gradient, *Path of pollutants, Coliforms, Effluents, Drainage, Wastewater treatment, Coastal plains, Bacteria, Soil disposal fields.

Locating conventional septic tank-soil absorption systems in high-water-table soils may produce shallow groundwater pollution. The movement of fecal coliforms was studied at two private sites in Chesapeake, Virginia, elevated 5 and 6.7 meters above sea level in loamy, mixed thermic Typic Ochraquults, one fine and one coarse. Monitoring wells were at 152 cm (shallow) and 305 cm (deep). Sampling was done every 2 or 3 weeks from January 1977 to September 1979. This site with a nearby drainage ditch (water table gradient 3.2%) showed fecal coliform movement in a predominantly horizontal direction. Shallow well lognormal coliform levels were 340 MPN per 100 ml, and deep well levels, < 3 per 100 ml. The second site, with poor drainage, had lognormal fecal coliform densities of 25-150 per 100 ml in the shallow wells and 10 per 100 ml in the deep wells. These values indicate a greater vertical movement of effluent at the second site. Coliform counts in wells varied widely through the year, being low when the water table level was below the drain field (August-December) and high the rest of the year. Nonuniform distribution of effluent was seen in soils at both locations. (Cassar-FRC)
W82-02325

EVALUATION OF WATER QUALITY DURING HERBICIDE APPLICATIONS TO KERR LAKE, OK,
Oklahoma Water Resources Board, Oklahoma City. Water Quality Div.
K. Morris, and R. Jarman.
Journal of Aquatic Plant Management, Vol 19, p 15-18, July, 1981. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Herbicides, *Water quality standards, *Aquatic weed control, Weed control, Nutrients, 2,4-D, Ammonia, Phosphorus, Nitrogen, *Fate of pollutants, Reservoirs, Kerr Lake, Oklahoma, Monitoring.

State water quality standards were not violated during herbicide treatment of Eurasian watermilfoil in the Robert S. Kerr Reservoir, Oklahoma, during 1977 and 1978. In 1977 five sites were treated (158.1 ha) with the butoxyethanol ester of 2,4-dichlorophenoxy acetic acid (2,4-D BEE). In 39 water samples analyzed, the herbicide was detected only once in the Little Sans Bois Creek area. However, nutrient levels were significantly increased. The 1978 program involved treatment of 463.3 ha of water with 4218 kg of granular 2,4-D BEE in June and 3833 kg applied to 202.6 ha in August. Water quality monitoring of 809 water samples resulted in herbicide detection (3 micrograms per liter) 4 hours after treatment at one site.

This is far less than the 100 micrograms per liter standard. No 2,4-dichlorophenol, a by-product, was detected in samples. There were statistically significant increases in total P at three sites and a decrease in ammonia at one site. (Cassar-FRC)
W82-02327

RELATIONSHIPS BETWEEN POND SEDIMENTS AND SIMAZINE LOSS FROM WATERS OF LABORATORY SYSTEMS,
Delta Experiment Station, Stoneville, MS.
C. S. Tucker, and C. E. Boyd.
Journal of Aquatic Plant Management, Vol 19, p 55-57, July, 1981. 2 Tab, 14 Ref.

Descriptors: *Herbicides, *Aquatic weed control, *Degradation, *Simazine, Weed control, Fate of pollutants, Sediments, Ponds, Adsorption, Sinks.

Pond sediments were the major sink for simazine applied to fish ponds. In flasks containing pond water alone, 20% of the simazine was lost from the water 32 days after application; in water-sediment systems, 75%. Organic content was positively correlated and pH was negatively correlated with the rate of simazine disappearance. Simazine half-lives for sediments containing < 0.5% organic matter and 15-30% clays were 61.2-72.5 days; for soils with 8.7-9.0% organic matter and 26-37% clay, 7.8-7.9 days. Soils with intermediate amount of organic matter had simazine half lives of 10.8-43.4 days. There were 16 samples of sediment investigated. (Cassar-FRC)
W82-02330

SUMMER INTERNAL PHOSPHORUS SUPPLIES IN SHAGAWA LAKE, MINNESOTA,
Corvallis Environmental Protection Agency, OH.
D. P. Larsen, D. W. Schults, and K. W. Malueg.
Limnology and Oceanography, Vol 26, No 4, p 740-753, July, 1981. 5 Fig, 7 Tab, 50 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Eutrophication, Fate of pollutants, Water pollution effects, Water pollution control, Tertiary wastewater treatment, Sediments, Glacial lakes, Lakes, *Shagawa Lake, *Minnesota, Anaerobic conditions.

Installation of a tertiary wastewater treatment plant at Ely, Minnesota, in 1973 was expected to reduce mean P concentration in Lake Sagawa, a small, shallow, soft water glacial forest lake. Although wastewater P loading was reduced by 99% and loading from all external sources by 80%, the lake continues to be highly productive, especially during July and August. The source of P was internal, corresponding to internal supply rates of 240-680 kg per week over a 3-9 week interval in summer. The P release took place during anaerobic conditions, the time of which varied from year to year (1971-1975). The P content of the surface sediments was 0.2-0.5% dry weight, and a large proportion was potentially mobile, 27.7 to 72.8% (NaOH extractable). The upper 10 cm of sediments was estimated to contain 50,000 kg of potentially mobile P, enough to supply P to lake water for about 20 years at the present release rate. (Cassar-FRC)
W82-02332

GEOTHERMAL ENERGY: AN OLD ALLY,
For primary bibliographic entry see Field 2F.
W82-02333

SOURCE AND EXTENT OF KLEBSIELLA PNEUMONIAE IN THE PAPER INDUSTRY,
Wisconsin Univ.-Madison. Dept. of Veterinary Science.
N. R. Caplenas, M. S. Kanarek, and A. P. Dufour.
Applied and Environmental Microbiology, Vol 42, No 5, p 779-785, November, 1981. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Bacteria, *Pulp and paper industry, *Wastewater analysis, Fate of pollutants, Water pollution sources, Coliforms, Klebsiella pneumoniae, Water reuse, Wastewater treatment, Water quality, Effluents.

The fates of fecal coliform and Klebsiella pneumoniae, an opportunistic pathogen, were traced through the pulp and paper manufacturing process. Fresh water used in 3 types of mills (groundwood pulp, sulfite pulp and fine paper, and drinking pulp and fine paper) contained up to 490 per 100 ml fecal coliforms and < 10 per 100 ml total K. pneumoniae. Bacterial concentrations were high throughout the pulping process and increased during water recycling, up to 3 million total K. pneumoniae per 100 ml. Although wastewater treatment produced some reduction in total fecal coliforms in some samples, total K. pneumoniae, especially the thermotolerant type, was little affected. The paper industry is a source of pathogens, both within the plant and in the receiving waters. (Cassar-FRC)
W82-02337

SIMULATION OF NUTRIENT BALANCES IN A SHALLOW AND POLLUTED RIVER: A STRATEGY FOR ENVIRONMENTAL CONTROL,
Osaka Univ. (Japan). Dept. of Fermentation Technology.
S. Aiba, and H. Ohtake.
Annals of the New York Academy of Sciences, Vol 369, p 219-233, 1981. 9 Fig, 22 Ref.

Descriptors: *Simulation, *Nutrients, Cycling nutrients, Rivers, *Environmental control, Dissolved oxygen, Biological oxygen demand, Phosphorus, Phosphates, Enrichment, Eutrophication.

A model developed for simulation of biological oxygen demand, dissolved oxygen and phosphate-phosphorus in a shallow river (Tama-gawa) demonstrates the significant role of periphytic algae in the nutrient balance. This role of periphytic algae is significant not only in shallow rivers, but also in polluted ones. Phosphorus fixed by algal photosynthesis and that precipitated onto the river bottom amounted in total to about 38% of the daily input of phosphorus to the water body. The algal growth was inevitably accompanied by secondary biological oxygen demand (BOD) loading. About 35% of the daily input of BOD into the river originated from algal decay. It was concluded that increasing the water quantity was effective in greatly improving the water quality, but that inflow of nutrients from tributaries was the main cause of the progressive enrichment in the selected example. The new procedure used in this study to solve the partial differential equations appearing in the one dimensional model was more advisable than either the multi-step or the conventional implicit procedures used in earlier studies, as it minimized the computation time while guaranteeing good accuracy. (Baker-FRC)
W82-02354

FATE AND EFFECTS OF A HEAVY FUEL OIL SPILL ON A GEORGIA SALT MARSH,
Skidaway Inst. of Oceanography, Savannah, GA.
R. F. Lee, B. Dornseif, F. Gonsoulin, K. Tenore, and R. Hanson.
Marine Environmental Research, Vol 5, No 2, p 125-143, 1981. 11 Fig, 1 Tab, 30 Ref.

Descriptors: *Salt marshes, *Oil spills, Tidal marshes, Fate of pollutants, Aquatic life, *Water pollution effects, Oily waters, Sediments, Oysters, Periwinkle, Snails, *Georgia.

On November 13, 1978, 40 gal of a No. 5 fuel oil were added to 1 acre of a Spartina alterniflora salt marsh bordering the Wilmington River in Georgia. Fluoranthene, phenanthrene, and chrysene were dissolved in the fuel oil before the oil was added to the marsh. On December 5, 1978, an additional 20 gal of the fuel oil were added to a 10 meter by 3 meter section within the previously oiled area. The oil was sprayed on the surface of the marsh at low tide. Animals were collected at various times after the oil additions and analyzed for polycyclic aromatic hydrocarbons by high pressure liquid chromatography. The marsh sediment consisted of 61% sand, 12% silt, and 26% clay. The highest concentrations of phenanthrene, chyrsene and fluoranthene in the sediment were 112, 105 and 75 ng/g sediment, respectively. These concentrations decreased rapidly during the 20 week period after the spill. The times for these hydrocarbons to decrease to 50% their original concentration were about 100, 70, and 30 days in sediment, mussels, and oysters, respectively. Benthic macrofauna species showed no chage in some cases, and in others either an increase or decrease in population. No changes were noted in populations of fiddler crabs, oysters, or mussels. Mud snails increased in density after the spill due to immigration of adult snails from untreated areas to scavenge on animals killed by the oil. Many of the adult periwinkles were killed by the oil. In the spring, juvenile periwinkles recolonized to oil areas as a result of larvae settling. (Baker-FRC)
W82-02358

KEPONE DISTRIBUTION IN THE WATER COLUMN OF THE JAMES RIVER ESTUARY - 1976-78,
Virginia State Water Control Board, Richmond. Div. of Ecological Studies.
C. A. Lunsford.
Pesticides Monitoring Journal, Vol 14, No 4, p 119-124, March, 1981. 1 Fig, 4 Tab, 16 Ref.

Descriptors: *Organic pesticides, Rivers, *Kepone, *James River, Organic compounds, Pesticides, Sediments, Stratification, Thermal stratification, Temperature effects, Estuaries, Coastal waters, Virginia.

The results of Kepone water column monitoring in the James River estuary during the period 1976-1978 are reported. The James River discharges at an average rate of 212 cubic meters per second. Samples were collected quarterly at 75 stations from four areas of the estuary. The analysis of kepone residues showed a range of concentrations from 0 to 1.20 ppb. Concentrations in James River sediment samples ranged from 0 to 5 ppm. Differences in kepone concentrations at the surface and at the bottom of the water column were not significant. Concentrations were highest during July through September. It was felt that temperature may affect the partition coefficient of kepone in water/sediments. The peak in kepone concentrations may be due to increased numbers of phytoplankton in the water column. These summer increases may require imposing restrictions on summer dredging in kepone contaminated areas of the estuary. Spatial variations in water column residue concentrations were also noted, with residues averaging higher in the middle reach of the estuary. It is urged that future studies include investigations of dissolved and suspended solids phases of kepone in the water column. (Baker-FRC)
W82-02360

A METHOD FOR OBTAINING SLOPE INFORMATION FOR HYDROLOGIC MODELS,
Ball State Univ., Muncie, IN. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W82-02364

SOURCES OF TWELVE TRACE METALS IN ANTARCTIC SNOWS DETERMINED BY PRINCIPAL COMPONENT ANALYSIS,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
C. Boutron, and S. Martin.
Journal of Geophysical Research, Vol 85, No C10, p 5631-5638, October, 1980. 5 Fig, 4 Tab, 26 Ref.

Descriptors: *Trace metals, *Snow, *Aerosols, Air pollution, Statistical analysis, Snow sampling, Water pollution sources, *Antarctic.

Sources of Antarctic aerosols were investigated by a statistical analysis of the trace metals concentrations measured in the snow layers deposited at various sites of the ice cap. The method used was principal components factor analysis of the observed temporal and geographical variations of the measured concentrations. Two hundred and fifty surface snow samples were collected for trace metal analysis, and 12 elements were determined (Na, Mg, K, Ca, Fe, Al, Mn, Pb, Cd, Cu, Zn, and Ag). Typically, three areas were delimited accord-

ing to the observed variations. The first one was near the coast (5-35 km), the second 43-173 km, and the last one at 173-1070 km. Some trace metals have an oceanic source, while others may have a crustal continental source (Al, Fe, and Mn). This technique should be applied to larger set of data, including concentrations data for numerous other elements. When method results are proven, they can be used in mathematical models. (Small-FRC)
W82-02378

A STUDY ON THE ACCUMULATION OF COPPER AND ZINC IN THE MID-GUT GLAND OF CULTURED SCALLOP FOR ENVIRONMENTAL MONITORING, (IN JAPANESE),
Iwate Univ., Morioka (Japan). Div. of Forestry and Fishery.
S. Kamimura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 10, p 1245-1248, October, 1980. 4 Fig, 3 Tab, 6 Ref. (English summary).

Descriptors: *Bioaccumulation, *Copper, *Zinc, Mollusks, Marine animals, Bioindicators, *Scallop, Accumulation, Heavy metals, Monitoring, Mathematical studies, Statistical analysis.

A statistical analysis of the accumulation profiles of copper and zinc in the mid-gut glands of cultured scallops was performed to determine their ambient levels. The levels of both copper and zinc in the gland were found to increase as the organ weight increased. A linear relationship between copper and zinc levels and organ weight was observed. The coefficient of the correlation was characteristic for the ambient level. The analysis confirmed the usefulness of the profile analysis of the heavy metals accumulation in the mid-gut gland for estimating the trend of their levels in the environment. This study also indicated that cultured scallops could be a suitable indicator organism for use in environmental monitoring. (Carroll-FRC)
W82-02379

ACCUMULATION OF HEAVY METALS IN ARID-ZONE SOILS IRRIGATED WITH TREATED SEWAGE EFFLUENTS AND THEIR UPTAKE BY RHODES GRASS,
Hebrew Univ., Rehovot (Israel). Dept. of Soil and Water Sciences.
A. Banin, J. Navrot, Y. Noi, and D. Yoles.
Journal of Environmental Quality, Vol 10, No 4, p 536-540, October/December, 1981. 2 Fig, 6 Tab, 22 Ref.

Descriptors: *Heavy metals, *Irrigation water, *Wastewater irrigation, Impaired water use, Metals, Rhodes grass, Grasses, Sprinkler irrigation, Secondary wastewater, Clays, *Soil chemistry, Fate of pollutants, Cadmium, Chromium, Lead, Zinc, Copper, Nickel.

Heavy metal accumulation was determined in soils of commercial fields of Rhodes grass with 12 to 28 year histories of sewage effluent irrigation. Plots in three soils (a loamy sand, a sandy loam, and a clay loam) were irrigated with sewage effluent or tap water at the rate of 7000-8000 cu meters per ha per year. There were no statistically significant differences in levels of Cr or Zn in all soils and in both treatments. Cd levels were significantly higher than in controls in all three soils. Cu, Ni, and Pb levels were higher than controls in the clay soils. Concentrations of available or acid-extractable metals were generally higher (except for Cr) in effluent-irrigated fields than in tap water-irrigated fields. Rhodes grass samples grown in effluent-treated soils were higher in metals (except for Cr) than tap water-treated crops. As the surface area (or clay content) of the soil increased, the enrichment factor (micrograms element per g plant/micrograms element per g soil) increased, being more pronounced with the more labile metals, Cd, Cu, and Ni. The relative magnitude of the enrichment factor was Cu > Cd > Pb > Ni > or = Cr. This relationship depends on the solubility in water, which is in turn dependent on ionic potential. (Cassar-FRC)
W82-02392

CHARACTERIZATION OF OIL SPILLS ON INLAND AND ESTUARINE WATERS,
North West Water Authority, Warrington (England).
P. J. Whittle, and M. W. Horne.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 50-60, January, 1980. 8 Fig, 3 Tab, 2 Ref.

Descriptors: *Oil spills, *Chemical analysis, *Oil-water interfaces, *Oil pollution, *Tracers, Estuaries, Streams, Gas chromatography, Hydrocarbons, Dyes, Fuel, Laboratories, Dye concentrations, Reservoirs.

The techniques used in the analysis of polluting oils are discussed. Capillary chromatographic columns have been used to advantage, and may increase in efficiency with future developments. If inorganic based phases are developed, this technology coupled with mass spectrometry would provide an improved method of analysis. Infra-red spectrometry has limited application. Other techniques will include the quantitative detection of other elements present in the oil by means of plasma source spectrometry. Future advances will include microprocessed controlled instrumentation and data-handling systems. Chromatographic analysis of an oil of unknown origin which entered a reservoir via a feeder stream after a heavy rain revealed a peak corresponding to cis-cis double bonds, found in rubber. A search of the source area revealed old quarry workings in which an estimated 60,000 tons of used tires had been dumped and burned. Since the pollution incident about 85,000 gallons of oil have been removed from this reservoir, but heavy rain still occasionally washes out more oil from underground. (Titus-FRC)
W82-02393

THE IMPACT OF URBANIZATION ON SEASONAL HYDROLOGIC AND NUTRIENT BUDGETS OF A SMALL NORTH AMERICAN WATERSHED,
Wisconsin Univ.-Madison. Inst. of Environmental Studies.
V. J. Watson, O. L. Loucks, and W. Wojner.
Hydrobiologia, Vol 77, No 1, p 87-96, 1981. 2 Fig, 5 Tab, 16 Ref.

Descriptors: *Nutrients, *Hydrologic budget, *Urbanization, Fate of pollutants, Lakes, Water quality control, Phosphorus, Nitrogen, Runoff, Seasonal variation, *Lake Wingra, *Wisconsin, Small watersheds, Watersheds, Lake morphometry.

The effects of urbanization on the nutrient, and hydrologic budgets of Lake Wingra, a small shallow lake in Madison, Wisconsin, was determined by comparing seasonal water inputs, nutrient yields, and N:P ratios before and after urbanization. Seepage contributes 69% of the water inpuet to the lake. The total hydrologic budget and the springs and groundwater and the rainfall components of the budget were similar for pre- and post-settlement eras. However, in pre-settlement times spring runoff was 85% of total runoff and summer runoff, 0.58%. Modern runoff is 48% in spring, 20% in summer. Most of the N input to the lake is from the groundwater, 68% pre-settlement and 60% present; from runoff, 10% presettlement and 17% present. Most of the P input is from runoff, 42% pre-settlement and 71% present. This increase in runoff with resultant decreases in evapotranspiration and subsurface flow has increased annual P loadings (680 to 1000 kg P) and decreased the N:P ratio of total loading (40 to 26, a 35% change). The annual N budget did not change significantly, 27,000 kg N in pre-settlement times and 26,000 kg N in the present. The pre-settlement lake area was 1.75 times the present area and the volume was 1.5 times the present volume. These changes, produced by dredging, filling and damming, contributed substantially to the increased concentration of nutrients. Water quality control measures suggested are: (1) concentrate on reducing P in runoff in spring and summer by diversion of runoff into marshes not bordering lakes or into detention ponds, and (2) minimize lake modifications which reduce water volume. (Cassar-FRC)
W82-02400

DENMARK'S STATE OF THE ENVIRONMENT,
B. Wilder.
Ambio, Vol 9, No 2, p 104-106, 1980. 3 Fig, 3 Ref.

Descriptors: *Water quality, *Water pollution control, *Denmark, Reviews, Mercury, Heavy metals, Streams, Seas, Coastal waters, Recreation demand.

The degree of improvement in environmental conditions in Denmark since the passage of the 1974 Environmental Protection Act was investigated. Denmark has vast quantities of clean groundwater as a resource, but a number of potential threats to its clean condition exist. Characteristics of seepage and underground waterflow tend to cloud future predictions, as the effects of surface pollution may not appear in groundwater for decades. Improvement has been noted in the quality of Denmark's lakes and streams. In spite of confusing factors of crop watering, silage disposal and contamination by pesticides and ochre, the Danish streams were rated cleaner than they had been 10 years ago. Seas and coastal areas around Denmark have been threatened by sewage and oil spills. The mercury load is particularly high in certain areas. In the open seas precipitation is the major source of heavy metal pollution. The quality of the water for recreational purposes has improved. (Baker-FRC)
W82-02401

ESTUARINE AND MARINE COASTAL POLLUTION IN THE REPUBLIC OF IRELAND,
University Coll., Cork (Ireland). Dept. of Zoology.
A. Myers.
Marine Pollution Bulletin, Vol 12, No 8, p 260-264, August, 1981. 1 Fig, 3 Tab.

Descriptors: *Reviews, *Ireland, *Estuaries, Coasts, Fisheries, Cork Harbour, Bantry Bay, Harbors, Bays, *Industrial wastes, Environmental protection, Coastal waters, *Water pollution sources.

Industrial development in Ireland has been concentrated in the vicinity of coastal towns, where almost one half of the population resides. The increase in population plus industry in coastal towns has escalated the volume of waste materials entering Irish coastal waters. The volume of waste materials entering Irish coastal waters has been estimated to be increasing at about 10% per year. Much of the recent work in pollution of waters has been centered around assessment in organisms of heavy metals, organic poisons, sewage, and radioactive materials. A multivariate approach has been carried out in studies at Trinity College to study intertidal and peritidal zones of east coast estuaries. Particular emphasis is placed on eutrophication by phosphorus and nitrogen, the addition of organic matter including hydrocarbons, and the distribution of heavy metals. Pollution in Cork Harbour, an area undergoing rapid industrial development, has also been the object of several studies. Possible effects of an oil transhipment terminal in Bantry Bay have been considered. Pollution research with an emphasis on marine studies at the universities has largely been funded on an ad hoc basis from national funds, but with the establishment in 1977 of the National Board for Science and Technology, a National Environmental Sciences Program was initiated which had as one of its priorities the development of a research program in estuarine and marine coastal pollution. The need for long term base-line research on unpolluted coasts and estuaries in the Republic is pressing, not only to safeguard Ireland's marine environment, but to gain a better understanding of the behavior of animal communities in pristine marine environments in temperate regions. (Baker-FRC)
W82-02418

GROUNDWATER QUALITY IN THE SEVERN-TRENT REGION,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
For primary bibliographic entry see Field 5A.
W82-02423

DISTRIBUTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENTS FROM

ESTUARIES OF SOUTHEASTERN AUSTRALIA,
Melbourne Univ., Parkville (Australia). Dept. of Industrial Science.
J. Bagg, J. D. Smith, and W. A. Maher.
Australian Journal of Marine and Freshwater Research, Vol 32, No 1, p 65-73, 1981. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Aromatic compounds, *Sediments, Path of pollutants, Water pollution sources, Polynuclear aromatic hydrocarbons, Organic compounds, *Australia, Estuaries, Rivers, Benzo(a)pyrene, Urban areas, Industrial development, Aerosols.

Levels of the polycyclic aromatic hydrocarbons (PAH), benzo(a) pyrene (BAP) and perylene, were determined in sediments from 23 sites in 3 locations in southeast Australia. Minimum BAP values of 20-60 micrograms per kg dry weight were found at Mallacoota Inlet, remote from urban activity. The maximum concentration, 6800 kg micrograms per kg, was from a Yarra River tributary (Melbourne region) where sediment was contaminated with an oily material. Other levels in the Yarra estuary system ranged from 60 micrograms per kg at the station farthest upstream to 850 micrograms per kg downstream. In Corio Bay, a marine bay near a small city, concentrations of BAP were 180-260 micrograms per kg, except for near a storm water drain inlet, 2000 micrograms per kg. The ratio of BAP: perylene was 1-2, significantly lower than PAH deposited by aerosol. This suggests that the major source of PAH is industrial activity. (Cassar-FRC)
W82-02438

THE SEASONAL VARIATION IN SILICON CONCENTRATION IN CHALK-STREAMS IN RELATION TO DIATOM GROWTH,
Freshwater Biological Association, Warham (England).
H. Casey, R. T. Clarke, and A. F. H. Marker.
Freshwater Biology, Vol 11, No 4, p 335-344, August, 1981. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Silicon, *Streams, Seasonal variation, Benthos, Diatoms, Chlorophyll A, Rivers, Water chemistry, *Path of pollutants.

Changes in silicon concentration were exained over a relatively long time scale in order to separate regular seasonal cycles from erratic between-year variations. These concentrations were then used to calculate diatom production. The first study site was a bore-hole at a commercial watercress farm. The second was at a point 5 km downstream on the Bere Stream, and the third site was on the River Frome. These water courses are nutrient-rich hardwater streams dominated by macrophytes. Weekly water samples were taken at each site. No apparent seasonal variation was noted in silicon concentration at the bore-hole. In contrast, 5 km downstream there was marked reduction in silicon concentration during the spring but only irregular changes during the rest of the year. Silicon concentrations in the River Frome between 1965 and 1977 showed considerable variations, apart from the substantial reductions in the spring. A negative correlation between suspended chlorophyll-a and silicon concentrations confirms that suspended chlorophyll-a concentrations respond more closely to changes in the loosely attached diatom flora than to other sources of chlorophyll-a. However, neither variable is always suitable for monitoring changes in benthic diatoms. Estimates of diatom production, based on changes in silicon concentration, gave rates of 1-2 grams of silicon/square meter/day in a small headwater chalk stream during the spring. (Baker-FRC)
W82-02439

STORMWATER QUALITY PROCESSES FOR THREE LAND-USE AREAS IN BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Mattraw, Jr., and R. A. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-119595, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-23, 1981. 56 p, 13 Fig, 16 Tab, 22 Ref.

Descriptors: *Storm runoff, *Urban runoff, *Water quality, Rainfall-runoff relationships, Fallout, Urban hydrology, Data collections, Hydrologic data, *Florida, *Broward County.

Systematic collection and chemical analysis of stormwater runoff samples from three small urban areas in Broward County, Florida, were obtained between 1974 and 1977. Thirty or more runoff-constituent loads were computed for each of the homogeneous land-use areas. The areas sampled were single family residential, highway, and a commercial shopping center. Rainfall, runoff, and nutrient and metal analyses were stored in a data-management system. The data-management system permitted computation of loads, publication of basic-data reports and the interface of environmental and load information with a comprehensive statistical analysis system. Seven regression models relating water quality loads to characteristics of peak discharge, antecedent conditions, season, storm duration and rainfall intensity were constructed for each of the three sites. Total water-quality loads were computed for the collection period by summing loads for individual storms. Loads for unsampled storms were estimated by using regression models and records of storm precipitation. Loadings, pounds per day per acre of hydraulically effective impervious area, were computed for the three land-use types. Total nitrogen, total phosphorus, and total residue loadings were highest in the residential area. Chemical oxygen demand and total lead loadings were highest in the commercial area. Loadings of atmospheric fallout on each watershed were estimated by bulk precipitation samples collected at the highway and commercial site. (USGS)
W82-02469

SIMULATION MODEL FOR AGRICULTURAL NON-POINT-SOURCE POLLUTION,
Montgomery (J. M.), Walnut Creek, CA.
L. J. Tubbs, and D. A. Haith.
Journal of the Water Pollution Control Federation, Vol 53, No 9, p 1425-1433, September, 1981. 6 Fig, 7 Tab, 28 Ref. OWRT-B-053-NY(5), 14-34-0001-7169.

Descriptors: *Model studies, *Nonpoint pollution sources, Pollution load, *Agricultural runoff, Mathematical studies, Phosphorus, Nitrogen, *Nutrients, Simulation, Runoff.

A mathematical simulation model, referred to as the Cornell Nutrient Simulation (CNS) model, is presented which is suitable for estimating dissolved and solid-phase nitrogen and phosphorus in runoff, and dissolved N in percolation from cropped fields with well-drained soils. The CNS model consists of two basic components: a daily soil moisture/erosion submodel that predicts runoff, percolation and soil loss; and a monthly submodel of soil nutrient levels. Validation studies for several small fields in Georgia and New York are included. The nutrient component has a monthly time step. The nutrient balance model estimates monthly losses of dissolved and solid-phase N in runoff, dissolved N in percolation, dissolved P in runoff, and solid-phase P in runoff. Validation studies in Georgia were performed in two small fields that were monitored for runoff, sediment and nutrient loss in runoff from May, 1974 through September, 1975. The New York testing sites are six 0.3 ha plots in Aurora, New York, from which runoff, percolation, and nutrient loss data were collected from January 1972 through December 1973. Measured nutrient, water, and sediment losses were compared with those predicted by the CNS model. Runoff predictions exceeded observations by substantial amounts on both fields in Georgia, although errors were smaller on one. Dissolved N and P were over-predicted by about the same degree as runoff on one field. The most critical problem is in the simulated losses of dissolved P in runoff. In New York there were additional problems which made comparisons of the predictions and the observations meaningless. The principal weakness of the model is in its handling of organic matter such as manures and fresh plant residues. (Baker-FRC)
W82-02504

EFFECT OF DRAINAGE SYSTEM DESIGN AND OPERATION ON NITRATE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs, and J. W. Gilliam.
Transactions of the ASAE, Vol 24, No 4, p 929-934, July/August, 1981. 9 Fig, 3 Tab, 20 Ref. OWRT-A-086-NC(7), OWRT-B-063-NC(6), 14-34-0001-7070, 14-31-0001-4111.

Descriptors: *Drainage, *Nitrates, Surface drainage, Drainage practices, Subsurface drainage, DRAINMOD, Model studies, Simulation, Resources management, Water pollution sources, Water table, Surface runoff, *Agricultural runoff, Groundwater management.

A study was made to simulate soil water conditions and nitrate outflow from artificially drained soils using a water management computer model. Simulations were conducted for various drainage system designs and operational criteria for a poorly drained soil. The simulation model used is an extension of the water management model, DRAINMOD, developed for drainage and water table control on shallow water table soils. The simulation model predicts water table position, water content distribution, surface runoff, subsurface drainage volume, and seepage volumes at the end of each time increment. If the nutrient concentration of each of the outflow sources is known or can be predicted, total mass outflows can calculated on a day to day basis for a given drainage system design and mode of operation. The performance of the water management system design was evaluated in terms of total annual nitrate outflow and its ability to satisfy trafficability and crop protection requirements. Drain spacing and the quality of surface drainage both have large effects on total annual outflows via surface runoff, subsurface drainage and seepage. Nitrate outflows for the experimental soil are heavily dependent on the drainage system design, and nitrate movement from the field can be minimized by using good surface drainage and wide subsurface drain spacings. While controlled drainage can be used to reduce nitrate outflows when surface drainage is poor, there are potential detrimental effects of designing controlled drainage systems for this purpose. Maintenance of a high water table over the winter months may cause breakdown of soil structure, which would reduce hydraulic conductivity and complicate the drainage problem. A decrease in nitrate may be accompanied by increased phosphorus or pesticide movement in the drainage waters. (Baker-FRC)
W82-02505

PHOTOSYNTHETIC PIGMENTS AS INDICATORS OF ALGAL ACTIVITY IN THE UPPER POTOMAC ESTUARY,
Georgetown Univ., Washington, DC. Dept. of Biology.
P. Sze.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157827, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia Report No 30, October, 1981. 19 p, 6 Fig, 2 Tab, 12 Ref. OWRT-A-015-DC(1), 14-34-0001-0109.

Descriptors: *Nutrients, Photosynthetic pigments, Chlorophyll A, Centric diatoms, Algae, Chlorococcalean green algae, *Potomac River, *District of Columbia, *Photoplankton, Water temperature, Sampling.

The Potomac River was monitored at Key Bridge from May - September, 1981. Temperature, major nutrients, photosynthetic pigments, abundance of major groups of photoplankton (direct counts), and potential photosynthetic production (oxygen method) were measured weekly in surface samples collected near mid-river. Chlorophyll A showed the same general trends as the cell counts and

production with greatest algal activity in late May and August and a minimum in June. Centric diatoms and chlorococcalean green algae were the major planktonic algae in 1981, as in previous years. The accessory pigments were relatively insensitive measures of algal composition. Overall, the activity of phytoplankton did not show any significant from previous years, and there was no evidence for prolonged nutrient depletion as a result of algal activity in the river.
W82-02529

DELINEATION OF ACID MINE DRAINAGE POTENTIAL OF COAL-BEARING STRATA OF THE POTTSVILLE AND ALLEGHENY GROUPS IN WESTERN PENNSYLVANIA,
The Pennsylvania State Univ., University Park. Dept. of Geosciences.
For primary bibliographic entry see Field 6A.
W82-02534

THE EFFECTS OF RAPID INFILTRATION OF MUNICIPAL WASTEWATER ON GROUNDWATER QUALITY,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
H. S. Peavy, P. E. Stark, and T. G. Schwendeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157900, Price codes: A05 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 117, September, 1981. 72 p, 3 Fig, 8 Tab, 11 Ref, Append. OWRT-A-127-MONT(1), 14-34-0001-0128.

Descriptors: *Groundwater pollution, *Wastewater lagoons, *Water pollution sources, Aquifer characteristics, Soil chemistry, Water quality control, Water analysis, Wastewater disposal, Path of pollutants, *Infiltration, Rapid infiltration, West Yellowstone, *Montana.

The purpose of the research project was to compile and summarize the available information on groundwater quality changes due to rapid infiltration of wastewaters, and to add to that body of knowledge by a field investigation of a rapid infiltration site. A wastewater disposal system practicing rapid infiltration was selected and instrumented. Data was gathered by analyzing samples drawn from wells installed downstream from the infiltration basins. Background data was obtained by sampling existing water supply wells in the same aquifer but upstream from the disposal facility. The data indicated a several fold increase in Total Dissolved Solids, nitrate and ammonia in the groundwater near the infiltration basins. The elevated concentrations attenuated as the groundwater moved away from the area. Other parameters (pH, phosphates, chlorides, COD, fecal coliform bacteria) were not significantly affected by the infiltration of the wastewater. Conclusions are reached that groundwater quality will be affected on a local basis by rapid infiltration of wastewater. The extent of adverse impacts will depend on several variables relating to the volume and character of the wastewater and on infiltration site characteristics. (Hunt-Mont)
W82-02537

DISCUSSION OF TRACE METALS IN THE WATERS OF A PARTIALLY-MIXED ESTUARY,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W82-02542

SALT-WATER INTRUSION IN THE COSTA DE HERMOSILLO, MEXICO: A NUMERICAL ANALYSIS OF WATER MANAGEMENT PROPOSALS,
Connecticut Univ., Storrs. Dept. of geology and Geophysics.
R. W. Andrews.
Ground Water, Vol. 19, No 6, p 635-647, November/December, 1981. 11 Fig, 38 Ref.

Descriptors: *Saline water intrusion, *Irrigation wells, *Water management, Path of pollutants, *Coastal aquifers, Aquifers, Groundwater recharge, Recharge, Aquifer management, Irrigation water, Model studies, Solute transport, Hydraulic gradient, Wells, Chlorides, Simulation analysis, *Costa de Hermosillo, *Mexico.

The Costa de Hermosillo aquifer, Sonora, Mexico, is being actively intruded by salt water because groundwater withdrawls in this agricultural region are much greater than natural recharge. Total discharge varies between 760 and 1140 million cu meters per year. There have been overdrafts of 450 to 900 million cu meters per year since 1954, with a resulting water table decline up to 40 meters. A model is developed to simulate the hydrologic conditions and water quality to assess the areal and temporal variations in head velocity and concentration as a result of changes in the groundwater withdrawal. Major salt water intrusion has occurred in 2 areas, where total dissolved solids are now 1200 mg per liter. Buried alluvial channels allow rapid transport of salt water inland. Some of the proposals for managing the salt water intrusion problem are: (1) relocating 92 wells further inland to redistribute discharge, and (2) reducing the amount of water pumped from the aquifer by improving irrigation efficiency. No matter which management strategy is chosen, the salt water intrusion is irreversible. Simulated chloride distributions after 34 years depict the 300 and 3000 mg per liter isochlors for both management methods. The reduced pumping scheme is slightly less effective in slowing salt water intrusion because it specifies gradual withdrawal of wells from production over 15 years. The uncertainty in parameter identification permits only a qualitative analysis of these proposals. (Cassar-FRC)
W82-02547

HISTORY OF HUMAN-USE IMPACTS ON LONG POINT BAY,
H. B. Barrett.
Journal of Great Lakes Research, Vol 7, No 2, p 81-88, 1981. 7 Ref.

Descriptors: *Human population, *Environmental effects, Water pollution effects, *Long Point Bay, Canada, *Ontario, Farming, Industrial wastes, Pesticides, Silting, Erosion, Sedimentation, Hunting, Wildlife, Wilderness areas, Wildlife management, Wildlife conservation, Lakes, Lake Ontario, Water pollution sources.

The first detrimental impacts of man appeared on Long Point Bay regions during Indiana times, when erosion took place in areas which had been cleared for farming and left after the crops failed to thrive in succeeding years. Even so, the general impact on the environment caused by the Indian was minimal for almost 1,000 years. The arrival of the white man brought cultivation to various tracts of land. By the first half of the 19th century, activities were many and varied, with the greatest impact being felt due to uncontrolled and illegal lumbering. Wherever a cut was made, wind and water combined to destroy the thin topsoil, create blowouts, and in many cases wash the fragile exposed ridges into the surrounding water. Large parts of Long Point were lost wherever lumbering was carried out. In August of 1866 the Long Point Company was formed for the purpose of controlling the activities in that area which were leading rapidly toward environmental destruction. Almost complete removal of virgin forests in the 1830's and afterward caused the loss of the protective humus from the forest soils. The sediment load of Norfolk's streams increased dramatically and spawning and feeding areas for trout and other species were destroyed. Increased contamination with herbicides and pesticides have been noted in the Inner Bay due to increased agricultural activities. Added to the siltation from agriculture, commercial and urban growth was a great variety of complex pollutants. Toxic wastes from industry, vessels, and vehicles add additional stresses to the area. (Baker-FRC)
W82-02580

MULTIPORT DIFFUSER MIXING ZONES IN RIVERS,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
A. D. Parr, and W. W. Sayre.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 903-917, October, 1981. 12 Fig, 1 Tab, 6 Ref.

Descriptors: *Mixing, *Diffusers, *Thermal pollution, *Fate of pollutants, *Effluents, Effluent standards, Rivers, Heated water, Thermal water, Multiport diffusers, Temperature, Water temperature, Powerplants.

Empirical equations relating the cross-sectional area and discharge of an individual multiport diffuser mixing zone to effluent and ambient river conditions are developed. These are used with expressions for jet spreading and dilution to obtain mixing zone equations. The area enclosed in the isotherm defining the boundary of a single port mixing zone is determined as a function of downstream distance from port, velocity ratio, and critical dilution ratio. Agreement between predicted and measured mixing zone characteristics were reasonably good. This procedure can be used to estimate the river discharge below which environmental mixing zone limitations will be violated for particular multiport diffuser installations. (Cassar-FRC)
W82-02594

MODELING SUSPENDED SOLIDS AND BACTERIA IN FORD LAKE,
Rutgers - The State Univ., Piscataway, NJ.
C. G. Urchin, and W. J. Weber, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 975-993, October, 1981. 22 Fig, 3 Tab, 26 Ref.

Descriptors: *Bacteria, *Suspended sediments, *Sediment transport, Lakes, Coliforms, Model studies, Mathematical models, *Ford Lake, *Michigan, Turbulent flow, Open channels, Channel flow, Fate of pollutants, Suspended solids, Feces, Water quality.

Transport of suspended solids and associated pollutants is modeled for inclusion in a water quality model. Sediment dynamics is particularly important for nonreactive substances such as polychlorinated biphenyls. The submodel, developed for the case of turbulent open channels, uses a two-dimensional equation for suspended particles in a turbulent flowing medium. A procedure is developed to determine particle fall velocity distributions and a bottom boundary condition calibrated to three sets of flume data. The resulting numerical solution is shown in graphical form as a function of particle fall velocity, channel shear velocity, and channel depth. The model is applied in a system model for Ford Lake, Michigan, with fecal coliforms as the pollutant associated with the suspended sediments. Sedimentation proved to be a major removal mechanism for fecal coliforms in this lake. (Cassar-FRC)
W82-02595

GUIDELINES FOR CONTROL OF SEPTIC TANK SYSTEMS,
California Regional Water Quality Control Board, Oakland.
A. W. Olivieri, R. J. Roche, and G. L. Johnston.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1025-1034, October, 1981. 2 Fig, 17 Ref.

Descriptors: *Septic tanks, *Wastewater disposal, *Water quality control, Regulations, Water policy, San Francisco, California, Population density, Urban areas, Inspection, Maintenance, Nitrates, Bacteria, Percolation, Infiltration, San Francisco Bay area.

The San Francisco Bay Regional Water Quality Control Board, in response to rapid development in the jurisdiction, has set forth guidelines for individual or community sewer systems serving new residential development. This paper reviews

their recommendations with respect to design and construction of septic tank systems, operation and maintenance, and cumulative impacts. Since the half life of properly maintained septic tank systems is 25 years, dual systems are recommended to allow resting and restoration of percolation rates. Periodic inspection of individual septic tank systems is recommended to ensure proper maintenance and correlation of system failures. This is currently being conducted in the Stinson Beach area and includes biennial inspection of all private systems for pumping need, odor, and surfacing effluent. A new law allows small communities to build and maintain on-site wastewater treatment systems, where appropriate, with the technical assistance of public agencies. It was found that septic tank effluent may contaminate domestic water supplies, particularly private wells, and that nitrates may adversely affect coastal waters. Recommendations derived from the study were: (1) the bottom of drainfields and water supply wells should be vertically separated by at least 30-40 ft in decomposing granite soils and 10-20 ft in alluvial soils, (2) one housing unit per 1.4 acres will minimize nitrate contamination in local groundwaters, and (3) septic tank systems should be inspected peridocially. (Cassar-FRC)
W82-02599

5C. Effects Of Pollution

BIOLOGICAL CONSIDERATIONS RELATED TO FRESHWATER INTRODUCTION IN COASTAL LOUISIANA,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 4C.
W82-02128

HISTORICAL OVERVIEW OF THE FRESHWATER INFLOW AND SEWAGE TREATMENT PLANT DISCHARGES TO THE POTOMAC RIVER ESTUARY WITH RESULTANT NUTRIENT AND WATER QUALITY TRENDS,
National Oceanographic Atmospheric and Administration, Rockville, MD. Office of Marine Pollution Assessment.
M. A. Champ, O. Villa, and R. C. Bubeck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 350-373. 4 Fig, 11 Tab, 31 Ref.

Descriptors: *Potomac River estuary, *Nutrients, *Water quality, *Pollution load, *Wastewater disposal, River flow, Phosphorus removal, Limiting nutrients, Estuarine environment, Algal growth, Water pollution, Eutrophication.

Nitrogen, phosphorus and carbon loadings in the estuary have increased since the early 1920's. Algal and plant vegetation have undergone three major population and community shifts during the period of increased nutrient loading. Carbon loadings began to decline in the late 1950's with phosphorus decreasing in 1970. Nitrogen loadings have remained elevated with a small decline in the mid-70's. Extensive wastewater phosphate removal processes were initiated in 1974. During the summer of 1977 (a below-average flow period), the maximum was 80 micrograms/l for a 14-km reach of the estuary. The algal populations in 1979 were mixed, indicating that the water quality in the upper estuary is improving due to phosphorus being reduced by extensive removal from wastewater discharges. The Potomac River Estuary received in 1980 approximately 460 mgd of wastewater discharges from 8 sewage treatment plants in the upper estuary, which during low flow periods contribute significantly to the freshwater flow into the estuary. The removal of phosphorus has made it the limiting nutrient in the upper reaches of the estuary while in the lower reaches nitrogen or light penetration may be limiting. (Brambley-SRC)
W82-02161

EFFECTS OF UPLAND DRAINAGE ON ESTUARINE NURSERY AREAS OF PAMLICO SOUND, NORTH CAROLINA,
North Carolina Office of Coastal Management, Morehead City.
For primary bibliographic entry see Field 2L.
W82-02164

ENDANGERED ESTUARINE RECEIVING WATERS: THE EFFECTS OF LOW-FLOW LAND RUNOFF ON HEADWATERS BIOTA,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 419-432. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Estuarine environment, *Estuarine fisheries, *Perch, *Rhode River, Maryland, *Nutrients, Agricultural runoff, River flow, Eutrophication, Chlorophyll, Phytoplankton, Seasonal variation, Dissolved oxygen, Water temperature, Habitats, Nitrogen, Phosphorus, *Low flow, Environmental effects.

The Rhode River, Maryland, was studied over the course of one year to investigate a number of environmental parameters on the spawning and nursery ground activities of white and yellow perch. Total and nitrate-nitrogen, and total and orthophosphate-phosphorus were determined in the estuary and upstream, and land runoff and chlorophyll were determined. Most of the flow occurred in the winter, early spring, and mid to late fall. Phosphorus concentrations reached 2.4 mg/l in mid-July, and remained high through the autumn. Nitrogen levels were highest over this same period, with a maximum of 5.57 mg/l in mid-July. Dissolved oxygen levels seemed to correlate inversely with water temperature, although there were diurnal variations in dissolved oxygen levels. Chlorophyll in phytoplankton reached a maximum in mid-September of 12 mg/l. Cropland was the most important source of both nitrogen and phosphorus, and the nitrogen: phosphorus ratio was high enough for nitrogen to become limiting and eutrophication occurred. Reducing the nutrients in agricultural runoff would prevent eutrophication and produce a more favorable habitat for the perch. (Brambley-SRC)
W82-02165

THE EFFECT OF FOREST CLEARCUTTING IN NEW ENGLAND ON STREAM-WATER CHEMISTRY AND BIOLOGY,
New Hampshire Univ., Durham. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 4C.
W82-02178

PHYTOPLANKTON PRODUCTION AND COMMUNITY COMPOSITION IN A MARSH-DOMINATED ESTUARY WHICH RECEIVES SEWAGE WASTE,
Delaware Univ., Newark. Coll. of Marine Studies.
F. C. Daiber, and E. M. Simek, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153685, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Technical Completion Report, October, 1981. 73 p, 14 Fig, 6 Tab, 66 Ref, 3 Append. OWRT-A-052-DEL(1), 14-34-0001-1108.

Descriptors: *Phytoplankton, *Tidal marshes, Tidal streams, Productivity, Primary productivity, Aquatic productivity, Organic carbon, Diatoms, Dinoflagellates, Estuaries, Nutrients, *Eutrophication, Sewage, *Murderkill River estuary, *Delaware.

An investigation of the Muderkill River estuary, Delaware was conducted to describe the phytoplankton community, measure phytoplankton production and evaluate this production relative to other sources of organic carbon. Phytoplankton cell counts were highest in March, decreased to low levels by July, then increased and remained fairly uniform at high levels throughout late summer, autumn and winter. The community was dominated by diatoms in winter and spring, and small microflagellates in late summer and early autumn. Phytoplankton production averaged 380 gC/m2/yr, and the average water column respiration rate was 280 gC/m2/yr. During the year, phytoplankton produced an estimated 340 million grams of organic carbon, but water column respiration required 250 million grams of organic carbon. Phytoplankton production was sufficient to account for planktonic respiration from April through mid-October, but the plankton community was not self-sustaining during the rest of the year. Nutrient concentrations, augmented measurably by a wastewater treatment plant, supported high rates of production but the estuary as a whole does not appear to be distinctly eutrophic. A shallow eutrophic zone appeared to limit phytoplankton production. Phytoplankton produced less organic carbon than either the edaphic algae or emergent macrophytes in this marsh system. The phytoplankton contribution to the organic carbon pool in this estuary is considerably less than that from the marsh surface or upstream sources. Despite its relatively small quantitative contribution, phytoplankton carbon is of high quality and its importance in this system must not be discounted.
W82-02179

ENVIRONMENTAL CONTROL TECHNOLOGY DEVELOPMENT FOR GEOTHERMAL ENERGY,
Department of Energy, Oakland, CA. Geothermal Energy Div.
G. Katz.
Journal of the Water Pollution Control Federation Vol 53, No 10, p 1447-1451, October, 1981. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Water pollution effects, *Environmental control, *Geothermal resources, *Water pollution prevention, Water pollution sources, Ecological effects, Environmental effects, Geothermal power, Geysers, Springs, Thermal springs, Power plants, Thermal power plants, Air pollution.

Some environmental impacts from the use of geothermal energy in the United States and other nations are discussed. Surface water impacts include chemical degradation of domestic, recreational, agricultural and ecosystem resources. Subsurface impact is usually limited to chemical degradation of groundwater supplies. Water pollution sources connected with the harnessing of geothermal energy include well drilling muds, well effluents, power plant effluents and thermal stresses, spills of stored and transported chemicals, and wastes associated with pipeline breaks and power plant operation. Most environmental impact analysis work in the United States has been carried out at the Geysers, a vapor-dominated resource unit in California. With the development of liquid geothermal resources, new environmental issues have arisen. So far, the environmental impacts from geothermal energy utilization have been controllable by present technology. Careful effluent monitoring and a willingness to develop new control technologies when needed are required on a specific site/application approach basis. (Geiger-FRC)
W82-02197

CHEMICAL AND BIOLOGICAL PROCESSES CONTROLLING THE RESPONSE OF A FRESHWATER ECOSYSTEM TO COPPER STRESS: A FIELD STUDY OF THE CUSO4 TREATMENT OF MILL POND RESERVOIR, BURLINGTON, MASSACHUSETTS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
D. McKnight.
Limnology and Oceanography, Vol 26, No 3, p 518-531, May, 1981. 8 Fig, 4 Tab, 45 Ref.

Descriptors: *Reservoirs, *Copper sulfate, *Algal control, Copper, Eutrophication, Phytoplankton, Primary productivity, Toxicity, Ions.

The phytoplankton succession in Mill Pond (Burlington, Massachusetts) after treatment with CuSO4 was compared to the copper sensitivities of three important species from the pond. Also, the biological response of the aquatic environment to trace metal stress was evaluated. The CuSO4 treatment was performed to control a late summer bloom of Ceratium hirundinella. Initially, the treatment was toxic to C. hirundinella but not to Nannochloris sp. and Ourococcus sp. Initially primary production decreased, but returned to pretreatment levels. After two months, the total copper concentration in the epilimnion returned to background levels, and the phytoplankton was no longer dominated by copper tolerant species. Data indicated that the concentration of free copper ion determined the toxic response of the phytoplankton in the reservoir. (Small-FRC)
W82-02233

HEAVY METALS AND MARINE PHYTOPLANKTON: CORRELATION OF TOXICITY AND SULFHYDRYL-BINDING,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
N. S. Fisher, and G. J. Jones.
Journal of Phycology, Vol 17, No 1, p 108-111, 1981. 3 Fig, 1 Tab, 17 Ref.

Descriptors: *Algae, *Toxicity, *Heavy metals, Metals, *Phytoplankton, Asterionella, Mercury, Lead, Copper, Cadmium, Mangangese, Zinc, Water pollution effects, Sulfhydryl groups, Amino acids, *Diatoms, Sulfur compounds, *Australia.

The toxicities of 6 heavy metals to the marine diatom Asterionella japonica Cleve were correlated with the solubility products of the corresponding metal sulfides. Depression of growth rates by sublethal concentrations of the metals was greatest for Hg, which has the greatest affinity for sulfur. The EC50s (in micromoles) were as follows: Hg, 0.019; Cu, 0.2; Zn, 0.9; Pb, 1.0; Cd, 2.1; and Mn, 88.3. There was high correlation between log EC50 values and the stability constants of these metals for cysteine or methionine and with stability constants for non-sulfurous amino acids (glycine). However, the stability constants of metal-cysteine complexes were orders of magnitude greater than any metal-amide complex (metal-glycine). These results and those of other workers suggest that the mechanism of metal toxicity to algae is SH group binding, whereupon metabolic processes such as silica deposition are disrupted. (Cassar-FRC)
W82-02272

HYDROPOWER: UNTAPPED RESOURCE AND ENVIRONMENTAL HAZARD,
B. Dampier.
Ambio, Vol 10, No 5, p 252-253, 1981. 1 Fig, 1 Tab.

Descriptors: *Water resources development, *Hydroelectric plants, Water supply development, River basin development, Resources development, Dams, *Environmental effects, Powerplants, Hydroelectric power.

Currently hydropower generates roughly 23% of the world's energy supply. By the year 2020 that figure is expected to be almost quintupled. Perhaps the greatest experience with small scale hydropower is in China, where some 88,000 hydropower plants, averaging about 70 kW each, have been built in the past two decades. Most of the remaining unexploited hydropower reserves are located in the developing nations. Africa, Asia and Latin America together account for about 60% of the world's technically usable hydropower potential. How quickly these hydropower reserves are exploited depends on economic considerations such as construction and fuel costs and the costs of meeting increasingly stringent environmental protection requirements. It is also anticipated that both pumped storage and modifications to existing plants will increase the world's generating capacity. One of the most serious stumbling blocks for the unimpeded proliferation of large hydroprojects is the problem of siltation. Furthermore, large reservoirs created by dams encourage the spread of waterborne diseases such as malaria, schistosomiasis and sleeping sickness. (Baker-FRC)
W82-02277

NITRATE AND AMMONIA UPTAKE IN THE APEX OF THE NEW YORK BIGHT,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
C. Garside.
Limnology and Oceanography, Vol 26, No 4, p 731-739, July, 1981. 5 Fig, 1 Tab, 19 Ref.

Descriptors: *Nitrates, *Ammonia, *Productivity, Phytoplankton, *New York Bight, Nitrogen, Seasonal variation, Eutrophication, Algae, Light intensity, Nutrients, Fate of pollutants, Water pollution effects.

Nitrate and ammonia uptake were measured in the apex of the New York Bight during spring, summer, fall, and winter, 1977-78. Most of the sewage-derived N loading, up to 160 tons per day, reaches this area. Uptake was highest during spring and summer blooms (total nitrate plus ammonia uptake, 1.2 microgram atoms per liter), lowest in fall (total nitrate plus ammonia uptake, about 0.04 microgram atoms per liter). Uptake was a maximum at 50 microEinst per sq meter per sec and was inhibited at higher light intensities. In general, increasing ammonia concentrations caused decreases in nitrate uptake, which amounted to 50% of total inorganic N uptake at a concentration of 2 microgram atoms per liter ammonia. Doubling time of particulate N decreased as blooms developed (from 101 to 17 hours), and depletion times of nitrate and ammonia pools decreased from 7000 to 30 hours and 170 to 1 hour, respectively. At the onset of silicate- or nitrogen-limitation, doubling time and depletion times abruptly increased. Calculation of seasonal productivities gave the following results (in mg N per sq m per day): summer, 125 plus or minus 87; winter, 82 plus or minus 29; and fall, 22 plus or minus 5. (Cassar-FRC)
W82-02286

THE TOXICITY OF 2,4-D TO CYPRINUS CARPIO VAR. COMMUNIS IN RELATION TO THE SEASONAL VARIATION IN THE TEMPERATURE,
Udaipur Univ. (India). Dept. of Limnology and Fisheries.
H. K. Vardia, and V. S. Durve.
Hydrobiologia, Vol 77, No 2, p 155-159, 1981. 4 Tab, 21 Ref.

Descriptors: *Herbicides, *Toxicity, *Fish, Carp, 2,4-D, Seasonal variation, Temperature, Water temperature, Water pollution effects, *Weed control, Aquatic weed control.

The toxicity of 2,4-D, used for aquatic weed control, to carp (Cyprinus carpio) varied with water temperature. Jar tests with fish averaging 6.5 cm in length were performed with 2,4-D at concentrations of 3.2 to 45 ppm for up to 96 hours exposure at temperatures ranging from 17 to 39 C. At the highest temperature, 18 ppm of 2,4-D killed 100% of the fish within 24 hours. At the lowest temperature, 45 ppm of 2,4-D produced 60% mortality after 96 hours. The median tolerance limits (in ppm) at 96 hours were 5.10 at 39 C, 15.30 at 33 C, 20.00 at 28.5 C, 24.15 at 25 C, 31.25 at 20 C, and 35.00 at 17 C. There were no mortalities after 96 hours at 3.2 ppm (39 C), 5.6 ppm (33 C), 18 ppm (28.5 C), 20 ppm (25 C), and 25 ppm (20 and 17 C). (Cassar-FRC)
W82-02294

INTERNATIONAL CONFERENCE ON THE EFFECTS OF ACID RAIN URGES MORE RESEARCH IN CRITICAL AREAS,
Swedish Natural Science Research Council, Stockholm.
M. Falkenmark.
Ambio, Vol 9, No 3/4, p 198-199, 1980.

Descriptors: *Acid rain, *Conferences, *Chemistry of precipitation, Air pollution, Chemical reactions, Vegetation effects, Soil chemistry, Research priorities, Water pollution sources, Water pollution effects.

The International Conference on the Ecological Impact of Acid Precipitation attracted 300 scientists from 17 countries and included the following six main sessions: Transport and deposition, movement through vegetation and direct effects on vegetation, impact on soil and indirect effects on vegetation, effects on water quality, effects on aquatic biota, and integrated studies. The chemical composition of rain is affected by atmospheric pollution. As the rain filters down to groundwater supplies it is further modified by chemical interactions with vegetation and the soil. Catchment hydrology is a crucial factor, and the new Henriksen's acidification predictor diagram for lakes received much attention. This diagram summarized the hydrochemical conditions observed in numerous lakes in terms of pH in precipitation and Ca and Mg in river runoff. A number of research priorities were set, including an increasing focus on the aluminum set free by soil processes and integrated studies with a holistic view. (Small-FRC)
W82-02311

SEASONAL VARIATION IN THE TRACE METAL CONTENT OF MYTILUS EDULIS,
Portsmouth Polytechnic (England). Dept. of Chemistry.
R. Boalch, S. Chan, and D. Taylor.
Marine Pollution Bulletin, Vol 12, No 8, p 276-280, August, 1981. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Trace metals, *Mussels, Metals, Seasonal variation, Cadmium, Cobalt, Copper, Lead, Manganese, Mercury, Nickel, Zinc, Monitoring, Water pollution effects, *Coastal waters, Paignton, *England.

Data was sought on metal concentration in mussels in an uncontaminated environment at different times during the year. Mussels were obtained from a well established mussel bed in an uncontaminated coastal area at Paignton, South Devon. Thirteen consecutive monthly collections were made from February 1977 through February 1978, and an additional sample was taken in January 1979. The 'normal' values for trace metal content of individual Mytilus edulis covered a wide range, approaching three orders of magnitude in some cases. Although fairly dramatic changes occurred in the concentrations of some metals such as cobalt, manganese and mercury between August and September, there was little evidence of any overall seasonal pattern. Since the 'natural' range of trace metal concentrations varied so widely in this sample population, it is suggested that interpretations of changes in such parameters be made with great care. (Baker-FRC)
W82-02312

CONTROL OF AQUATIC WEEDS WITH HEXAZINONE,
Science and Education Administration, Davis, CA.
For primary bibliographic entry see Field 4A.
W82-02326

PERIPHYTON PRODUCTION IN AN APPALACHIAN MOUNTAIN TROUT STREAM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
L. E. Hornick, J. R. Webster, and E. F. Benfield.
American Midland Naturalist, Vol 106, No 1, p 22-36, July, 1981. 4 Fig, 5 Tab, 79 Ref.

Descriptors: *Periphyton, *Primary productivity, *Algae, Productivity, Guys Run, Virginia, Streamflow, Light intensity, Carbon, Nutrients, Seasonal variation, Aquatic environment.

Periphyton primary production was studied in Guys Run, Virginia, a second-order Appalachian Mountain stream, and in two of its tributaries during April 1977 to April 1978. Mainstream primary production averaged 2.27 mg C per sq m per hour (range, 0.4207.16) and in the tributaries, 1.37 mg C per sq m per hour (range, 0.15-5.46). Measurements were obtained in situ, using C14 fixation

in recirculating chambers. In all three streams primary production rates were highest in spring and early summer and declined during summer and autumn. Light, streamflow, and inorganic C influenced primary production. Correlations between primary production and nutrient levels were variable. Mean allochthonous input at five sites was 347 g per sq m per year vertical fallout and 113 g per sq m per year lateral movement or 230 g C per sq m per year. This gives an autochthonous primary production amounting to 3% of allochthonous inputs for the main stream and 2% for the tributaries. This autochthonous output may be underestimated because of sampling techniques. Autochthonous primary production may be of significant importance as a food source for macroinvertebrates in low-order streams during the spring and summer when leaf detritus availability is low. (Cassar-FRC)
W82-02335

INFRARED ABSORPTION STUDY OF HUMIC SUBSTANCES FROM LAKE APOPKA SEDIMENT, PLANKTON AND THE SURROUNDING DRAINAGE BASIN,
Florida Inst. of Tech., Melbourne. Dept. of Environmental Engineering and Science.
For primary bibliographic entry see Field 2H.
W82-02348

THE EFFECT OF AQUATIC HUMUS ON THE BIOLOGICAL AVAILABILITY OF CADMIUM,
Norsk Inst. for Vannforskning, Oslo.
E. T. Gjessing.
Archiv fur Hydrobiologie, Vol 91, No 2, p 144-149, May, 1981. 3 Fig, 7 Ref.

Descriptors: *Toxicity, *Cadmium, *Humic acids, Water pollution effects, Fish, Salmon, Algae, Chelation, Heavy metals, Metals, Aquatic life, Fate of pollutants.

Cadmium was less toxic to salmon and algae in waters containing aquatic humus than in plain tapwater. Atlantic salmon exposed to 1 mg Cd per liter showed 100% mortality at 32 hours in tapwater, at 47 hours in diluted humus water, and 80% mortality at 90 hours in concentrated humus water. 50% of algae cells were present after 4 days exposure using 5 micrograms Cd per liter in tapwater and about 60-70 micrograms Cd per liter with addition of humus water in the ratios 1:2 and 1:5. Curves were plotted for tapwater and humus concentrations of 1:2 and 1:5 and Cd concentrations from 1 to 500 micrograms per liter. At 10 micrograms Cd per liter about 20% of cells remained after 4 days in tapwater, about 65% in water with added humus at the 1:5 ratio, and over 100% in water with added humus at the 1:2 ratio. (Cassar-FRC)
W82-02353

PRODUCTIVITY AND SPECIES COMPOSITION OF ALGAL MAT COMMUNITIES EXPOSED TO A FLUCTUATING THERMAL REGIME,
Rensselaer Polytechnic Inst., Troy, NY.
D. L. Tison, E. W. Wilde, D. H. Pope, and C. B. Fliermans.
Microbial Ecology, Vol 7, No 2, p 151-165, 1981. 9 Fig, 6 Tab, 25 Ref.

Descriptors: *Aquatic life, *Thermal pollution, Heated water, *Temperature effects, Waste heat, Powerplants, Nuclear reactors, Nuclear powerplants, Nuclear wastes, Swamps, *Algal growth, Algae.

Attempts were made to determine the effect of large fluctuations in thermal regime on algal physiology and species composition at various temperatures in the thermal effluent from the Savannah River Plant. Nuclear production reactors from this plant discharge thermal effluents at 40-45 degrees C above ambient temperatures. Two of the reactors on the site have once-through cooling systems which take in water from the Savannah River and discharge thermal effluents into swamp areas, where temperatures cool to ambient before the waters return to the river. The thermophilic algal flora of this unique swamp habitat was compared with the thermophilic algae of natural hot springs. Rates of primary production and species composition were monitored at four sites along a thermal gradient in a trough microcosm. Blue-green (cyanobacter) were the only phototrophic primary producers growing in water above 45 degrees C. These thermophiles survived and apparently adapted to ambient temperatures when the reactor was shut down. The communities of the algal mat exposed to less than 45 degrees C were composed of blue-green and eukaryotic algae which adapted rapidly to ambient temperatures. During periods of thermal fluctuation an increase was noted in the percentage extracellular release of C-14 labeled dissolved organic compounds and a decrease in primary production. The study suggests that dominant phototrophs in this artificially heated aquatic habitat have been selected for their ability to survive large temperature variations and are similar to those found in natural hot springs. (Baker-FRC)
W82-02356

A COMPARISON OF THE INCIDENCE OF FIVE PATHOLOGICAL CONDITIONS IN SOFT-SHELL CLAMS, MYA ARENARIA, FROM ENVIRONMENTS WITH VARIOUS POLLUTION HISTORIES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
H. A. Walker, E. Lorda, and S. B. Saila.
Marine Environmental Research, Vol 5, No 2, p 109-123, 1981. 3 Fig, 4 Tab, 20 Ref.

Descriptors: *Clams, *Water pollution effects, Industrial wastes, Organic compounds, Monitoring, Water analysis, Oil refineries, Industrial plants, Oil industry, Oily water, Oil pollution, Rivers, Coastal waters, Estuarine environment, Comparison studies.

Two different analytical techniques were used to compare the distribution of occurrences and cooccurrences of five pathological conditions in samples of the soft-shell clam, Mya arenaria, collected at 17 locations on the east coast of the United States. In the first technique the relative fits of Poisson and Lagrange-Poisson distributions to the data were related to the mortality rate and spread of the pathological conditions. In the second technique, a severity index based on a matrix of occurrences and cooccurrences and the analysis of its eigenvectors were used to measure and to characterize the severity of the spread. The data suggested a possible relationship between the pollution history of the area and the incidence of pathological conditions in the populations surveyed. The occurrence of both neoplasia and hyperplasia affecting more than 10% of a given clam population was more often found in areas impacted with refined petrochemicals. It is suggested that crude oils and heavy metals had less effect on the incidence of hyperplasia and neoplasia than more refined petrochemicals. These two analytical methods demonstrated great utility for the intended comparisons and should find broad application to environmental monitoring and impact assessment studies in general. (Baker-FRC)
W82-02357

FATE AND EFFECTS OF A HEAVY FUEL OIL SPILL ON A GEORGIA SALT MARSH,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5B.
W82-02358

ENVIRONMENTAL REPERCUSSIONS OF IRRIGATION DEVELOPMENT IN HOT CLIMATES,
Ahmadu-Bello Univ., Zaria (Nigeria). Dept. of Environmental Health.
For primary bibliographic entry see Field 6G.
W82-02366

AN ASSESSMENT OF CURRENT STANDARDS FOR SELENIUM IN DRINKING WATER,
Kirkham Michael and Associates, Omaha, NE.
For primary bibliographic entry see Field 6F.
W82-02372

EFFECTS OF PH, PHOSPHATE, AND AMMONIA ON THE RATE OF UPTAKE OF NITRATE AND AMMONIA BY FRESHWATER PHYTOPLANKTON,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Hydrobiologia, Vol 76, No 1/2, p 23-26, 1981. 1 Fig, 4 Tab, 13 Ref.

Descriptors: *Nitrogen, *Phytoplankton, Absorption, Nitrates, Phosphates, Acidity, Ammonia, Natural waters, Algal growth, Nutrients, *Lake Carl Blackwell, *Oklahoma, *Hydrogen ion concentration.

During the summer of 1974 observations were made at Lake Carl Blackwell, Oklahoma, on the effect of phosphate and pH in regulating nitrate and ammonia uptake by phytoplankton using N-13 tracers. The high pH of the lake water noted during 1974 suggested that dissolved inorganic carbon (DIC) was a limiting factor. During 1975 the pH of the water was altered in efforts to vary the quantity of available DIC and added phosphate to see if DIC and phosphate interacted. At ambient pH there was little enhancement of nitrate uptake by additions of phosphate. Similarly nitrate uptake was not markedly changed by pH at any concentration of phosphate. Algal flora in the lake water during the 1975 experiments was a heterogeneous mixture of green algae, diatoms and bluegreen algae, predominantly the latter two groups. During July and August of 1973 the ambient concentration of ammonium limited nitrate uptake. The regression analysis indicates that nitrate uptake approached zero at a concentration of about 210 micrograms ammonium-nitrogen. (Baker-FRC)
W82-02398

STRUCTURAL CHARACTERISTICS OF ALGAL COMMUNITIES IN THERMAL ALTERED ARTIFICIAL STREAMS,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
E. W. Wilde, and L. J. Tilly.
Hydrobiologia, Vol 76, No 1/2, p 57-63, 1981. 1 Fig, 2 Tab, 35 Ref.

Descriptors: *Streams, *Temperature effects, *Algal growth, Algae, Seasonal variations, Simulation, Bottom sediments, Sedimentation, Sediments, *Thermal pollution, Stream biota.

Differences in algal communities developed and maintained under different temperature regimes are described, aong with some characterizations of the substrate affinities and associations of abundant taxa in a South Carolina blackwater stream system. The study site consisted of six artificial streams housed in a greenhouse on the banks of Upper Three Runs Creek near Aiken, South Carolina. Preliminary studies indicated that the algae in the artificial streams could be conveniently distinguished into the following five groups: rocky rapids algae, silty sediment algae, surface scum algae, sandy sediment algae, and miscellaneous attached algae. Thirty-two taxa were raked as abundant in at least one sample during the study. Temperature related shifts in the abundance of major species were demonstrated. Red algae were absent from a stream heated 12.5 degrees C above ambient, but remained abundant in streams heated 7.5 degrees C or less. Water temperatures above 30 degrees C produced blue-green algal dominance and eliminated several indigenous species. Substrate specificity was exhibited by all major taxa. Several taxa were abundant only on the bottom sediments, and others showed a distinct affinity for either sand or silt, which were the principal bottom types. The most obvious observed effect of chronic temperature elevations was the replacement of Vaucheria by Schizothrix. (Baker-FRC)
W82-02399

EFFECT OF PEMBROKE POWER STATION ON THE TEMPERATURES IN MILFORD HAVEN, WALES,
Central Electricity Generating Board, Bristol (England).
R. T. Jarman, and C. M. de Turville.

Water Science and Technology, Vol 13, No 7, p 295-304, 1981. 7 Fig, 5 Tab, 4 Ref.

Descriptors: *Temperature effects, *Electric powerplants, Thermal pollution, *Estuaries, Plumes, Water pollution effects, Powerplants, Water temperature, Cooling water, Outfall, Waste heat, Thermal stress, Model studies, *Milford Haven estuary, *Wales.

The effects of the heat discharge from the Pembroke Electric Power Station on Milford Haven Estuary, Wales, were examined using thermographs, boat surveys, and aerial infrared surveys of the outfall plume. Strong mid-channel currents tended to confine the plume to the southern section of the estuary during most of the tidal cycle. Plume impingement effects were noted at the two southern sample points closest to the outfall. A mean temperature rise of about 0.5 degrees/gigawatt generated/tidal cycle was observed at the Texaco Jetty site, with general warming creating an additional rise of approximately 0.7 degrees/gigawatt/tidal cycle. No significant correlations between temperature rise and electricity generation were found at any of the other sampling sites. A model of the long term heating of the estuary showed that the natural fluctuations in temperature were comparable to the temperature rises recorded at distances of 3 kilometers from the outfall. (Geiger-FRC)
W82-02406

ON THE TROPHIC STATUS AND CONSERVATION OF KASHMIR LAKES,

Central Inland Fisheries Research Inst., Harwan (India).
K. K. Vass.
Hydrobiologia, Vol 68, No 1, p 9-15, January, 1980. 5 Fig, 2 Tab, 22 Ref.

Descriptors: *Trophic level, *Lake classification, *Eutrophication, *Kashmir Valley, Water quality, Phytoplankton, Water pollution effects, Algae, Aquatic life, Aquatic plants, Water pollution control, India.

Limnologic data, especially trophic state, was documented for 3 lakes in the Kashmir Valley. The lakes (Dal, consisting of 3 sub-basins, Anchar, and Manasbal) lie in the Jhelum River flood plain and are shallow, mean depth 0.6-3.0 meters. Tendencies toward eutrophication were seen in the lakes' morphometry, increased oxygen in the surface layer, hypolimnetic oxygen deficit, increased specific conductivity (200-500 micro s at 25 C), pattern of assimilation curve, and increased phytoplankton production (185-600 mg C per sq meter per day). However, nitrates (20-25 micrograms per liter) and phosphates (5-10 micrograms per liter) were low, plankton blooms have not been observed, and plankton density was low. Dominant phytoplankton groups were Cyanophyta, Pyrrophyta, Chlorophyta, and Chrysophyta. Recommendations for slowing eutrophication in these lakes are: (1) zoning to prevent further development near the lakes, (2) elimination of sewage discharges into the lake from villages and houseboats, (3) controlling dredging, which releases nutrients from sediments, (4) removing weeds and algae by cutting, manatees, or grass carp, and (5) removing nutrients from wastewater before discharge into the lake. (Cassar-FRC)
W82-02412

GROWTH OF MYTILUS EDULIS IN NET BAGS TRANSFERRED TO DIFFERENT LOCALITIES IN A EUTROPHICATED DANISH FJORD,

Miljostyrelsen, Charlottenlund (Denmark). Marine Pollution Lab.
H. U. Riisgard, and E. Poulsen.
Marine Pollution Bulletin, Vol 12, No 8, p 272-276, August, 1981. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Eutrophication, *Mussels, *Fjords, Oxygen depletion, Algae, Wind, Brackish water, Seawater, Growth, Hydrogen sulfide, *Denmark.

Growth has been measured in mussels transferred in net bags to different localities in the brackish Danish fjord, Limfjorden, in which certain areas are heavily eutrophicated. Large areas in the fjord suffer each summer from oxygen from the sediments. The increase in flesh dry weight ranged from twice the starting weight at one station to four times as much at another. The net growth efficiency in most cases was about 60% and in two cases above 70%. This indicates that more than 2.3 of the absorbed food energy was used for growth by the mussels. Low growth rates in Mytilus were noted at two stations located in areas with seasonal oxygen depletion. Thus these growth experiments demonstrated that certain conditions of pollution can reduce the growth ability of Mytilus, these being conditions under which low oxygen tension or toxic hydrogen sulfide is released from the sediments on days without strong wind and efficient vertical mixing of the water. It is felt that monitoring Mytilus edulis grown in net bags under standardized conditions in marine recipients can be a useful tool in unveiling biological effects in monitoring programs. (Baker-FRC)
W82-02428

DISCHARGE AND CHEMICAL CHANGES IN A CHALK STREAM HEADWATER AFFECTED BY THE OUTFLOW OF A COMMERCIAL WATERCRESS-BED,

Freshwater Biological Association, Wareham (England). River Lab.
H. Casey.
Environmental Pollution, Series,B, Vol 2, No 5, p 373-385, 1981. 6 Fig, 2 Tab, 17 Ref.

Descriptors: *Streams, *Chemical composition, Farming, Phosphates, Flow discharge, Chemical reactions, Discharge measurement, Effluents, Watercress bed, Chalk stream.

The effects of an outflow from a commercial watercress bed were studied on the discharge and chemistry of a natural chalk stream headwater. The study area was the headwaters of the Bere Stream at Millum Head. The size, shape and management of watercress beds varies between regions and users. Stream discharges were high in the winter and low in late summer and autumn. The increase in discharge between sites 1 and 2 (0.191 and 0.20 cu m/sec respectively) was due to a small input from a side stream and chalk springs feeding water into the bed of the stream. Discharge from the outflow of the watercress bed had a mean value of 0.046 cubic meter/second. In November of 1978 the outflow from the watercress-bed was providing twice as much water to Bere Stream as the natural source at Millum Head. Weedcutting caused large variations in water depths, and a late autumn weedcut reduced the stream to a shallow trickle of water. The chemical composition of the Millum Head stream was stable except in times of heavy rain. The water is well buffered with respect to pH and calcium bicarbonate. The chemical composition of the watercress bed outflow showed much greater variation, due to human management. It was concluded that the discharge from the watercress bed outflow would have a beneficial effect upon the chalk stream headwater in low flow periods. The high concentration of reactive phosphate in the bed outflow water will raise stream reactive phosphate concentrations, as the bed is responsible for 39.3% of all reactive phosphate throughput. (Baker-FRC)
W82-02429

WATERBORNE DISEASE IS PREVALENT IN EGYPT,

C. L. Senn.
Journal of Environmental Health, Vol 43, No 1, p 30-31, July/August, 1980, 4 Tab.

Descriptors: *Water quality, *Human diseases, Diseases, Regulations, Standards, *Egypt, Regional development, Water supply, Water supply development, Waterborne diseases.

In a special study at the Children's Hospital and Cairo University involving 100 diseased infants age 3 months to 2 years, bacillary dysentery organisms were recovered from 22 cases. The suspected causes of illness in the remaining cases included viruses and other organisms. The infant death rate for Egypt is about 114 per 1000 live births, comparable to other countries in that region. Mothers are advised to breast feed their infants as long as possible. Mothers are advised to boil bottle milk, but probably many do not. Mothers in poor communities are supplied with powdered milk, but it is often reconstituted with contaminated water. Control of infant disease calls for education to minimize urine and fecal contamination of streams, and snail control by natural and chemical means. It is extremely important that water be piped into the homes, thus avoiding contamination of a common water supply by handling and dipping. This also facilitates washing of vegetables and fruits, dishes and utensils. Having water within the living unit promotes better personal hygiene and has caused reductions in several diseases. The existing water system of the Greater Cairo Region has been greatly over-taxed. Pressure is inadequate to carry water continuously to higher than the second floor in many places. Programs are needed to reduce leakage and wastage and which can offer adequate protection and enforcement programs to safeguard the water. (Baker-FRC)
W82-02435

ASPECTS OF WATER POLLUTION IN LAKE NAINI TAL, U.P., INDIA,

Kumaun Univ., Naini Tal (India). Dept. of Zoology.
M. C. Pant, P. K. Gupta, J. Pande, P. C. Sharma, and A. P. Sharma.
Environmental Conservation, Vol 8, No 2, p 113-117, Summer, 1981. 2 Fig, 4 Tab, 14 Ref.

Descriptors: *Lake Naini Tal, *Water pollution effects, *Coliforms, Water quality, Aquatic life, Lead, Manganese, Biochemical oxygen demand, Dissolved oxygen, Eutrophication, *India.

The water quality of Lake Naini Tal, India, was analyzed in a year long study which tested lake water samples for coliform bacteria, metallic ions, physico-chemical features, and biological characteristics. The most probable number of coliform bacteria varied from 0.59 times 10 to the 5th power per 100 ml during the spring to 3.61 times 10 to the 5th power per 100 ml during the monsoon. Dissolved oxygen concentrations were high near the surface and low near the bottom, and BOD values always exceeded 6.0 mg/liter. Concentrations of NO3-N and PO4-P were high enough to cause phytoplankton blooms upon occasion. Lead and manganese were found at higher than permissible levels. Most of the carp fish were infected with Saprolegnia or other fungi or with trematodes. Phytoplankton and zooplankton were abundant. Macrobenthic species were absent from the profundal zone of the lake, which was severely polluted. (Small-FRC)
W82-02442

RELATIONSHIP BETWEEN POPULATIONS OF AMPHIPODS AND POLLUTION,

Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
D. Bellan-Santini.
Marine Pollution Bulletin, Vol 11, No 8, p 224-227, August, 1980. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Amphipods, *Water pollution effects, *Aquatic populations, Aquatic animals, Crustaceans, Population dynamics, Population density, *Mediterranean Sea, *France, *Coastal waters, Gammarus.

The effects of pollution on the composition and distribution of amphipod populations inhabiting rocky environments in the French Mediterranean coastal waters have been investigated over an 18-year period. Nineteen series of between 10 and 15 samples of 400 square centimeters each were analyzed as to species, number of individuals, partial dominance, Shannon-Weaver and Margalef Index of diversity, and similarity index of Sanders. The area studied ranges from the Rhone delta to the peninsula of Embiez and includes the Gulf of Fos, which experiences strong industrial pollution, and the Cove of Cortiou, which receives mainly domestic wastes from the City of Marseille. The global study of the amphipod population showed

that the mean number of amphipod species decreased with increasing pollution; that the mean number on individuals decreased with increasing pollution; that the Margalef diversity index decreased when pollution increased; and that there appear to be two amphipod subpopulations: one in pure or very pure water and one in more or less polluted water. Eleven of the 39 amphipod species inventoried represented 74.9 percent of the total specimens. A total of 35 species of gammarids and 4 species of caprellids were represented by over 90,000 individuals. Although no characteristic group of species was found to be typical of areas affected by pollution, certain species were excluded by more severe pollution. The species of the genous Hyale, a grazing species, led the dominant group in pure or very pure water, while Jassa falcata and Podocerus variegatus, both suspension feeders, comprised the essential elements of the dominant group found in more or less strongly polluted waters. (Carroll-FRC)
W82-02444

AQUATIC BIOLOGY OF THE REDWOOD CREEK AND MILL CREEK DRAINAGE BASINS, REDWOOD NATIONAL PARK, HUMBOLDT AND DEL NORTE COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W82-02484

CUMULATIVE EFFECTS OF LOGGING ROAD SEDIMENT ON SALMONID POPULATIONS IN THE CLEARWATER RIVER, JEFFERSON COUNTY, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 2J.
W82-02507

CHARACTERIZATION OF SPAWNING GRAVEL AND STREAM SYSTEM EVALUATION,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 2J.
W82-02509

AGGLUTINATION AND BACTERICIDAL RESPONSES OF THE CHANNEL CATFISH TO SALMONELLA PARATYPHI,
Memphis State Univ., TN. Dept. of Biology.
D. D. Outh, and E. A. Wilson.
Developmental and Comparative Immunology, Vol 5, No 2, p 261-270, 1981. 2 Fig, 2 Tab, 20 Ref. OWRT-A-056-TENN(3), 14-34-0001-9045.

Descriptors: *Channel catfish, *Commercial fish, Fish farming, Agriculture, Recirculated water, Water reuse, *Catfish, *Bacteria, *Immunization, Salmonella paratyphi, *Antibiotics.

Intraperitoneal immunization of channel catfish, Ictalurus punctatus, with Salmonella paratyphi in Freund's complete adjuvant produced persistent agglutinating antibody titers of hundreds of thousands during a 1-year response. Bactericidal activity of 2 high-titered sera averaged 30% and 20%. Post-immunization bactericidal activity varied little and remained within 10% of pre-immunization bactericidal activity. Fresh channel catfish serum from unimmunized catfish exhibited 100% bactericidal activity against S. paratyphi. Lysozyme was present in fresh channel catfish serum at 1.8 micrograms/ml serum or 34 ng lysozyme/mg protein.
W82-02524

THE STUDY OF PHOSPHORUS AND NITROGEN FLUXES IN ENRICHED ISOLATION COLUMNS,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Botany.
A. J. Twinch, and C. M. Breen.
Hydrobiologia, Vol 77, No 1, p 49-60, 1981. 6 Fig, 44 Ref.

Descriptors: *Nutrients, *Algae, *Eutrophication, Periphyton, Phosphates, Nitrates, Seasonal variation, Sediments, Chlorophyll a, Water pollution effects, *Midmar Dam, *South Africa.

Nutrient fluxes were studied in 4 isolation columns placed in 3.5 m of water in Midmar Dam, South Africa, a turbid oligotrophic impoundment. The columns were enriched weekly to add the following (in micrograms per liter): P, 150; N, 200; and P, 150, plus N, 200. One column was left unenriched as a control. All enrichment treatments caused increased chlorophyll concentrations. Large seasonal variations were observed. Addition of phosphate alone only increased chlorophyll concentrations to the point of nitrate limitation. Most of the phosphate was adsorbed by sediments. Nevertheless, soluble reactive P concentrations were high in August-October. This was probably a result of P mobilization from the sediments. Addition of nitrate produced no response in chlorophyll levels between April and early August, but in summer (January-March) a bloom of Microcystis sp. occurred. Enrichment with both phosphate and nitrate produced eutrophic conditions in January-March. (Cassar-FRC)
W82-02563

HISTORY OF HUMAN-USE IMPACTS ON LONG POINT BAY,
For primary bibliographic entry see Field 5B.
W82-02580

5D. Waste Treatment Processes

MICROBIAL PURIFICATION OF RECYCLED WASTEWATER IN A CLOSED SYSTEM,
West Virginia Univ., Morgantown. Water Research Inst.
W. J. Shoupp, J. M. Dingess, and P. G. Moe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153693, Price codes: A04 in paper copy, A01 in microfiche. Information Report 15, 1981. 64 p, 18 Fig, 11 Tab, 98 Ref. OWRT-A-034-WVA(2), 14-34-0001-9052.

Descriptors: *Domestic wastes, *Microorganisms, *Reclaimed water, *Recycling, *Sewage bacteria, *Wastewater disposal, *Wastewater treatment, Biodegradation, Ecological balance, Ecological distribution, Ecosystems, Microbial degradation, Microbiology, Septic tanks, Wastewater pollution.

A recycling sanitary-waste disposal system was developed and tested in the laboratory by using a synthetic fecal-urinous waste material. The system was capable of supporting an aerobic microbial population with an organic loading equivalent to the waste of three adults by using an aeration rate of 12 liters of air per minute. Increasing the temperature of the digestion tank from 23 C to 34 C reduced the rates of sludge and ammonia-nitrogen accumulation but had little effect on BOD-reduction efficiency. Reducing retention time of the waste in the digestion tank increased the rate of mineral-salt accumulation but had no deleterious effect on the microbial population during an eight-week period. Shock loads of feed up to seven times normal rate caused temporary perturbations, but the microbial population in the system showed remarkable stability and rapid recovery. Indicator organisms were unable to establish themselves in the microbial population and perished within a few hours indicating no serious health hazards in a home. The BOD-reduction efficiency was generally better than 85 percent, and the total carbon (carbon dioxide) lost was better than 95 percent. The main limiting factors were inadequate aeration and mineral-salt accumulation.
W82-02172

A FIELD EVALUATION OF SELECTED WATER CONSERVATION AND WASTEWATER REDUCTION SYSTEMS FOR RESIDENTIAL APPLICATIONS,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 3D.
W82-02180

THE EFFECT OF PH AND HALOGENS ON THE STABILITY OF REVERSE OSMOSIS MEMBRANES,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
S. B. McCray, J. Glater, and J. W. McCutchan.
Report UCLA-ENG-8115, WRC 73, July, 1981. 115 p 60 Fig, 10 Tab, 40 Ref, 2 Append.

Descriptors: *Reverse osmosis, *Halogens, *Hydrogen ion concentration, *Membrane processes, *Wastewater treatment, Salt rejection, Cellulose acetate membranes, Fluctuations, Polymers, Disinfection, Bromine, Chlorine, Iodine, Membranes.

Recently there has been an increase in the number of reverse osmosis plants built for the reclamation of wastewater, agricultural water, and industrial cooling water. Crucial to the operation of a reverse osmosis plant is the pretreatment of the feed water. To control microbiological growth, water disinfectants such as chlorine, iodine, bromine chloride, and chlorine dioxide are used. This study examines the response of certain commercial reverse osmosis membranes, including cellulose acetate and various types of polyamide homogeneous and composite films, to various chemical environments. For cellulose acetate, product flux is found to increase exponentially with time, while salt rejection decreases linearly. Rate constants describing these processes have been calculated at various temperatures. Results indicate that product flux and salt rejection follow first order and zero order kinetics, respectively. Activation energies have also been calculated for flux increase and salt rejection decline for cellulose acetate at pH 2.0 and 8.6. Apparently water flux and salt rejection are controlled by different mechanisms. In general, cellulose acetate membranes are resistant to halogens for up to three weeks at concentration levels equivalent to 30 ppm Cl-2. All other membranes tested, however, are attacked by halogen agents under certain conditions, depending on solution pH and polymer type. The agents showing greatest promise for disinfection of polyamide membranes are chlorine dioxide at near-neutral pH and iodine at any pH level from 3.0 to 8.6. (Garrison-Omniplan)
W82-02188

ECONOMIC IMPACT OF EXISTING AMMONIA NITROGEN WATER QUALITY STANDARD, IPCB CHAPTER 3, RULE 203 (F),
Southern Illinois Univ. at Carbondale. Dept. of Thermal and Environmental Engineering.
C. B. Muchmore, W. M. Lewis, R. C. Heidinger, M. H. Poller, and L. J. Wawronowicz.
Illinois Institute of Natural Resources, Chicago, Document No 81/23, July, 1981. 202 p. 42 Fig, 28 Tab, 68 Ref, 8 Append.

Descriptors: *Ammonia, *Water quality standards, *Nitrogen compounds, *Water treatment facilities, *Ammonium compounds, Ionization, Nitrogen, Nitrification, Fish populations, Economic aspects, Operating costs, Capital costs, Stream pollution, *Economic impact, *Illinois.

This economic impact study was designed to provide additional information on existing ammonia nitrogen water quality standards by determining the actual effect of ammonia nitrogen on fish diversity and number based on measurements at selected sites in Illinois. In addition, further cost data were desired. The results of the study support the importance of considering concentrations of un-ionized ammonia, rather than total ammonia, in establishing allowable levels for Illinois streams. A previously suggested value of 0.04 mg/l un-ionized ammonia is consistent with the results of this study for the higher-diversity streams studied. For those streams that are not capable of supporting a diverse fish population, somewhat higher ammonia levels would probably not produce adverse effects. The major economic impact of attaining the current 1.5 mg/l ammonia nitrogen water quality standard would be on local government. The current evaluation confirmed the estimate of a previous study that municipal facilities would require about $180 million for capital investment, and $12 million in annual costs. Private dischargers would require $100 million in capital investment and $6 million in annual operating costs. Available cost

estimates to provide nitrification facilities for some of the treatment plants in this study indicated annual operating costs alone to be in the range of $0.83 to $2 per person. The economic impact of enforcement of the existing standard on industry was estimated to be $33.6 million in capital investment and $1.8 million in annual operating costs. The economic burden on agriculture is estimated to be small. (Garrison-Omniplan)
W82-02189

INDUSTRIAL PRETREATMENT NEEDS TO BE OVERHAULED AT THE NATIONAL LEVEL.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1452-1456, October, 1981.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Sewage, *Water quality standards, Municipal wastewater, Wastewater management, Hazardous materials, Pretreatment of water, Water pollution control, Environmental protection, Guidelines, Standards, Regulations.

The Federal Water Pollution Control Act of 1972 requires pretreatment of industrial wastewater before discharge to municipal systems. Although most municipal treatment authorities have sewer use ordinances, many metropolitan regions do not have active discharge control programs. Progress in the implementation of industrial sewerage plans has been slow due to complex pretreatment regulations as result of court actions and administrative decisions within the environmental Protection Agency. Also, more research is needed on the types of toxic wastes controlled under certain pretreatment schemes. The current state of the national pretreatment policy is discussed, along with five steps recommended by the Water Pollution Control Federation to improve the program. The five recommendations advocate distinguishing between direct and indirect industrial dischargers, establishing uniform pretreatment requirements for old and new indirect dischargers, eliminating the concepts of 'indicator pollutants' and removal credits, and encouraging stronger state and local pretreatment programs through federal actions. (Geiger-FRC)
W82-02198

ENGINEERING DESIGN VARIABLES FOR THE ACTIVATED SLUDGE PROCESS.
American Society of Civil Engineers, New York. Committee on Water Pollution Management.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE3, p 473-503, June, 1980. 12 Fig, 16 Tab, 19 Ref.

Descriptors: *Design criteria, *Wastewater treatment, Effluents, Nutrients, Sludge disposal, Lagoons, Nitrogen, Phosphorus, *Activated sludge process, Aerated lagoons, Oxidation ditch.

Operational criteria of a specific biological process and its modifications which are often used in secondary waste treatment of predominantely domestic wastewaters are reviewed. Variations of the activated sludge process considered include the conventional process, step aeration, tapered aeration, complete mix, aerated oxidation lagoon, oxidation ditch, high purity oxygen, contact stabilization, Draus process, high rate extended aeration, and modified or combination processes. Factors such as efficiency of biological oxygen demand removal, efficiency of suspended solids removal, cost of construction, efficiency of operation, quantity of sludge production, and nutrient removal must be considered for each variation of the overall method in selecting what is best for use in a particular situation. Operational data was obtained from waste treatment plants in Florida, Maine, New York, Pennsylvania and Virginia. It appeared in general that plants with 0-1 mgd flows achieved higher percentages of BOD and SS removals than did the larger facilities. In most cases where actual performance fell short of design performance, this was due to combinations of design and operation shortcomings. Common design faults include peak flow wash-out rates in final settling tanks, hopper slopes less than 60 degrees, settling velocities in channels and piping carrying activated sludge solids, insufficient return sludge capacity and control, and insufficient oxygen available and distributed to meet demand. This review also considered the characteristics of raw wastewater, nutrient requirements of aerobic processes, toxic and shock load sensitivity, sludge handling and disposal, and nitrogen and phosphorus removal. (Baker-FRC)
W82-02199

PROCESSES--NOT PRODUCTS--BIGGEST ENERGY-SAVING FACTORS.
Water and Sewage Works, Vol 127, No 11, p 43, 62, November, 1980. 1 Fig.

Descriptors: *Energy conservation, *Wastewater treatment, *Water treatment, Costs, Cost analysis, Conferences, Reviews.

This article reviews in general the emphasis placed on energy conservation measures in water and wastewater treatment fields. One major emphasis of recent energy seminars is to analyze treatment plants not only from the standpoint of how the industry's use of energy compares with total energy requirements of the nation, but also how different parts of the total treatment system rate comparatively. Much effort has been put into extracting the last measure of efficiency from a particular system component, when vastly greater energy savings might be gained from other areas of the treatment train. Since treatment phases are interrelated, it is often necessary to work back and forth between different phases to gain an understanding of the entire picture. The performance of the treatment facility can also be affected by the quality of the wastewater itself. Emphasis in the seminars was also given to overland flow, infiltration, and spray irrigation. Energy conserving peripheral devices such as heat exchangers, automatic and computer controls and active and passive solar energy collectors were discussed. (Baker-FRC)
W82-02218

BIODEGRADABILITY STUDIES WITH ORGANIC PRIORITY POLLUTANT COMPOUNDS,
Municipal Environmental Research Lab., Cincinnati, OH.
H. H. Tabak, S. A. Quave, C. I. Mashni, and E. F. Barth.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1503-1518, October, 1981. 2 Fig, 7 Tab, 37 Ref.

Descriptors: *Biological wastewater treatment, *Microbial degradation, *Pollutants, *Wastewater treatment, Biodegradation, Pesticides, Polychlorinated biphenyls, Organic compounds, Organic wastes, Gas chromatography, Dissolved solids, Organic carbon.

The microbial degradation and acclimation of 96 of the 114 organic priority pollutants included in the US EPA Consent decree list were studied by a static-culture flask-screening procedure using gas chromatoraphy, dissolved organic carbon (DOC) and total organic carbon (TOC) analysis. Phenol was used as a control compound in each biodegradability evaluation series. For incubation and unmetabolized substrate recovery, various techniques were used for phenols, phthalate esters, naphthalenes, monocyclic aromatics, polycyclic aromatics, polychlorinated biphenyls, halogenated ethers, nitrogenous organics, halogenated aliphatics, and organochlorine insecticides. Good agreement was noted for results obtained using the present technique and those found in the literature, utilizing a variety of biodegradation procedures. Priority pollutants that showed no significant degradation under the static-culture-flask methodology cannot be presumed to be completely recalcitrant to microbial action. More rigorous methods are recommended to ascertain the microbial biodegradability of pollutants that did not pass the static-culture-flask screening tests. (Geiger-FRC)
W82-02231

DUPONT'S WASTEWATER TREATMENT APPROACH,
DuPont Co., Wilmington, DE.
D. C. Hubinger, and D. G. Hutton.
Industrial Wastes, Vol 27, No 5, p 41-43, September/October, 1981. 2 Fig, 3 Tab.

Descriptors: *Chemical wastewater, *Activated carbon, *DuPont Company, *Wastewater treatment, Industrial wastewater, Biological treatment, Organic compounds, Chemical industry.

The DuPont Co. uses the PACT process (powdered activated carbon/biological treatment) to treat 35 mgd of wastewater from its Chambers Works, a complex chemical manufacturing plant, as well as 30-40 tank loads trucked in daily from other waste generators. The two-step process includes primary treatment by lime neutralization and settling (removes heavy metals, acids, and solids) and the patented PACT process (removes organics and color). Primary sludge of 45% solis is disposed of in a lined landfill. Powdered activated carbon is added to the primary clarifier effluent as it is fed to biological aeration tanks. After final clarification with polyelectrolytes, the effluent is lagooned and then discharged to the Delaware River. Sludge from the biological treatment process is treated in a multiple hearth furnace where biomass and organics are destroyed and carbon removal, 65%, in spite of the variable composition of the feed. The PACT process is available for licensing by other companies. (Cassar-FRC)
W82-02254

ENVIRONMENTAL PHENOTYPIC VARIATION OF SCENEDESMUS DIMORPHUS IN HIGH-RATE ALGAE PONDS AND ITS RELATIONSHIP TO WASTEWATER TREATMENT AND BIOMASS PRODUCTION,
Ben-Gurion Univ., Sde Boker (Israel). Inst. for Desert Research.
G. Oron, G. Shelef, and A. Levi.
Biotechnology and Bioengineering, Vol 23, No 10, p 2185-2198, October, 1981. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Wastewater treatment, *Algae harvesting, Proteins, Algal growth, Algae, Biological oxygen demand, Ponds, Aerated lagoons, Nutrients.

The practical and economic aspects of high rate algae pond operation for wastewater treatment and protein production were investigated using two pilot ponds and two fields, each of about 0.1 hectare, continuously fed with raw sewage for a total biological oxygen demand (BOD) of about 300 mg/liter, from an adjacent residential quarter. The pond effluent depth was kept at 35-45 cm, and an average flow rate of 10 cm/second was maintained. The predominant species was Scenedesmus dimorphus, although during certain periods Micractinium pusillum and M. quadrisetum were dominant. On monitoring the ponds it was noted that S. dimorphus was capable of appearing in at least four identifiable forms. Studies of these changes in form were conducted in a series of miniponds, each 110 liters in volume and 40 cm in depth, with different mixing and aeration methods applied. Effluent samples were drawn from the miniponds twice a week and analyzed for BOD and chemical oxygen demand. The conditions under which each form of S. dimorphus was grown were categorized. The relationship between the algal biomass and treatment efficiency and operational conditions was then examined in a set of experiments which included continuous and periodic mixing and aeration methods. The findings indicated that changes in the appearance of S. dimorphus were affected by variations of climatic conditions and operating regime, as well as by the nuritional fertility of the medium. These changes morphologically included types of colony arrangements, cell shapes, and chloroplast distributions. Wastewater treatment efficiency and algal yield were also correlated with the S. dimorphus type produced. (Baker-FRC)
W82-02275

PILOT-SCALE INVESTIGATIONS WITH GRANULAR ACTIVATED CARBON,
Thames Water Authority (England).
R. J. Vincent.

Effluent and Water Treatment Journal, Vol 21, No 8, p 351-354, 356, 357, August, 1981. 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Activated carbon, Carbon, Adsorbents, Trace metals, Industrial wastes, England, Filtration, Water treatment, Water supply.

Use of granular activated carbon for treatment of a sewage effluent is discussed. GAC treatment was studied at two distinct points in the water supply progression: first from sewage effluent at the Deephams sewage works, and second from slow sand filtered water at the Coppermills filtration station. Deephams has a dry weather discharge of 185,000 cubic meters/day and treats a sewage derived from the industrialized area of northeast London, using the activated sludge process. Coppermills filtration station is able to supply 491,000 cubic meters/day to a large area of eastern London, with raw water obtained from the River Lee or the River Thames. After long term storage, usually 100 days in artificial reservoirs, the water is treated by rapid sand filtration and slow sand filtration prior to chlorination and distribution. Application of GAC filtration to the Deephams effluent clearly produced an improved effluent quality in terms of total organic carbon, biological oxygen demand, and color, with efficiencies dependent on empty bed contact time. The lifetime of the filter with regard to adequate removal of trace organic compounds is not known. The Deephams effluent also contained significant amounts of certain trace metals. These were reduced during GAC filtration, but only during the first operational period of the GAC. For the second operational period, the GAC was reactivated and returned to the filter. No significant reduction of zinc or cadmium occurred during this operational priod. This change was attributed to the failure of the reactivation process to remove refractory adsorbates. (Baker-FRC)
W82-02289

SIMULATION OF A TIME DEPENDENT ACTIVATED SLUDGE WASTEWATER TREATMENT PLANT,
Texas Univ. at Austin. Dept. of Civil Engineering.
W. Tanthapanichakoon, and D. M. Himmelblau.
Water Research, Vol 15, No 10, p 1185-1195, October, 1981. 9 Fig, 1 Tab, 30 Ref.

Descriptors: *Model studies, *Wastewater treatment, Mathematical models, *Activated sludge process, Simulation, Monitoring, Clarifiers, Aeration, Water treatment facilities.

A dynamic model of an activated sludge waste treatment plant is described, examples of typical simulation results are offered, and a sensitivity analysis of an example plant is given. The model consists of three components, a primary settler, an activated sludge aeration tank, and a final clarifier-thickener. Particular care was taken in modeling the plant components to properly represent the mixing of materials that occurs within each of its units. The dynamic model compiled represents the operation of a typical plant reasonably well and in considerable detail. The model is general enough so that the values of the model parameters can be replaced with those applicable to a specific plant with little effort on the part of the analyst. Such models can be used in the design of new plants and in the analysis of the operations of existing ones. With the aid of this model it was posible to simulate simultaneously the diurnal response of a number of significant variables, including dissolved biological oxygen demand, suspended solids, dissolved volatile solids, active mass, inert mass, soluble nonbiodegradable mass, Nitrosomonas mass, Nitrobacter mass, ammonia, nitrite, nitrate and dissolved oxygen. The equations for the model as well as the results of simulations are presented. (Baker-FRC)
W82-02303

PHOSPHORUS REMOVAL BY ACTIVATED ALUMINA,
Technion-Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Narkis, and M. Meiri.
Environmental Pollution, Series B, Vol 2, No 5, p 327-343, 1981. 10 Fig, 1 Tab, 19 Ref.

Descriptors: *Water treatment, *Phosphorus removal, Acidity, *Wastewater treatment, Phosphates, Adsorption, Activated alumina.

The use of activated alumina for removal of phosphorus from sewage treatment plant effluents and from synthetic aqueous solutions was investigated. Analysis of various phosphorus compounds in biological treatment effluents showed that 99.4% of the total phosphorus is soluble, and 98% of this is present as inorganic orthophosphates. There are a number of forms of orthophosphates in equilibrium, with the predominant form changing as pH changes. Synthetic aqueous solutions of orthophosphates were prepared in distilled water at concentrations typical for sewage treatment plant effluents. In batch experiments, aeration biological treatment effluents containing 36.4 mg/liter of phosphate were treated with 1.5 g/liter of Merck acidic activated alumina. The pH was held at 5.7 and the temperature was 26 degrees C. Equilibrium was reached after 6.5 hr. When using various pH levels, maximum phosphate removal was achieved from distilled water solution at 4.5 in both acidic and basic activated aluminas. Acidic Merck activated alumina showed a better removal capacity than basic alumina when tested on biological sewage treatment plant effluent. The presence of calcium or magnesium in sewage treatment plant effluent increases the alumina capacity for phosphate removal at pH 8.0, typical for effluents. The use of activated aluminas adds no salts to the treated water, nor does it produce a nuisance of sludge handling or treatment before ultimate disposal. The activated alumina can be easily regenerated with sodium hydroxide solution. The process is applicable to phosphorus removal from waste treatment effluent and clear wastewaters containing orthophosphates and polyphosphates with an efficiency higher than that obtainable by chemical precipitation or flocculation. (Baker-FRC)
W82-02313

COUPLED TRICKLING FILTER-ROTATING BIOLOGICAL CONTACTOR NITRIFICATION PROCESS,
Union Carbide Corp., South Charleston, WV.
D. Marsh, L. Benefield, E. Bennett, D. Linstedt, and R. Hartman.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1469-1480, October, 1981. 25 Fig, 1 Tab, 12 Ref.

Descriptors: *Nitrification, *Wastewater treatment, *Biological filters, *Trickling filters, Mathematical studies, Design criteria, Ammonia, Biological oxygen demand, Biological wastewater treatment, Hydraulic loading, Pilot plants, Suspended solids.

Pilot plant studies were used to determine the effectiveness of a rotating biological contactor system for the nitrification of trickling filter effluent. To quantify the relationship between effluent ammonia concentration, influent ammonia concentration and total BOD concentration, wastewater temperature, and media surface area for the Boulder, Colorado Waste Water Treatment Plant, an equation was developed. This expression showed that the effluent ammonia concentration varied directly with the influent ammonia concentration and the influent total BOD concentration, but varied inversely with the temperature and media surface area of the wastewater. For any RBC nitrification system, the change in the effluent ammonia concentration as a result of hydraulic surging was an important design criterion. An equation was developed to quantify the relationship between the surge effluent ammonia concentration, design loading factor, hydraulic loading and influent ammonia concentration. Results showed that the influent suspended solids concentration was essentially the same as the effluent suspended solids concentration, suggesting that little excess sludge will be generated during nitrification in a separate-stage RBC system. Settling column tests showed that the effluent suspended solids settle rapidly and should be easily removable in well-designed clarifiers. (Geiger-FRC)
W82-02315

SHALLOW-DEPTH SEDIMENTATION OF BIOLOGICAL MATERIALS,
Rensselaer Polytechnic Inst., Troy, NY.
H. R. Bungay.
Annals of the New York Academy of Sciences, Vol 369, p 335-340, 1981. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Sedimentation, *Biological samples, Separation techniques, *Water treatment, Wastewater, Wastewater treatment.

Performance of conventional sedimentation equipment for the sedimentation of biological materials is generally poor. However, sedimentation is of practical value in biological waste treatment processes, since costs are relatively low and subsequent processing steps benefit from lessening of their input loads. If collection efficiencies could be improved to over 90%, there would be highly significant savings on new plants due to smaller sized steps for biological oxidation. Conventional, shallow-depth, and cross-flow plate sedimentation offer different advantages. Lamellar sedimentation is gravity collection with a short sedimentation path. Designs tubes or closely spaced plates are finding practical use. Since shallow-depth sedimentation achieves high performance at low cost, it should be much widely used with biological systems. It may be possible to incorporate the settlers into other equipment such as industrial fermentors or biological waste treatment units. Potential uses include collection of algae, collection of particles less dense than the liquid, classification of different particles in a series of lamellar settlers with varying detention periods, and separation of particles that rise from those that settle. (Baker-FRC)
W82-02336

A COMPENDIUM OF EXPERIMENTAL WORK ON CHEMICAL PRECIPITATION OF SEWAGE,
T. Stones.
Water Pollution Control, Vol 80, No 3, p 421-432, 1981. 11 Fig, 25 Ref.

Descriptors: *Wastewater treatment, Water treatment facilities, Primary wastewater treatment, Aluminum sulfate, Lime, Acidity, Sludge, *Chemical precipitation, *Suspended solids.

The process of chemical precipitation consists of adding to the sewage prior to settlement a suitable chemical or mixture of chemicals with the object of coagulating colloidal matter and producing a flocculent precipitate which, as it settles, enmeshes and carries down the finely divided suspended matter and thus forms an adjunct to settlement. Optimum precipitation had been achieved with aluminum sulfate at pH 5.0 due to the formation of aluminum hydroxide by hydrolysis. In order to achieve good results, the pH had to be closely controlled. Rapid settlement of the precipitated matter was promoted by mechanical flocculation, regardless of what precipitant was used. Unless a sufficient dose of the chemical added is used, such treatment may not only be useless and expensive, but may actually hinder rather than assist purification. No significant precipitation occurs with aluminum sulfate unless a dose larger than 50 mg/liter is used. The precipitating effect of small doses of lime and acid may be more than offset by the suppression of the biological purification that would otherwise occur. The doses of precipitants which have been shown to be necessary for effective precipitation also give rise to the formation of bulky sludges, and the disposal of these is another factor to be considered. (Baker-FRC)
W82-02370

TREATMENT OF EFFLUENT WATERS CONTAINING CHLORIDES BY REVERSE OSMOSIS DYNAMICALLY FORMED MEMBRANES,
Kuwait Univ. Dept. of Chemical Engineering.
H. I. Shaban.
Journal of Environmental Science and Health, Part A, Vol 16, No 4, p 359-372, 1981. 6 Fig, 12 Ref.

Descriptors: *Chlorides, *Reverse osmosis, *Wastewater treatment, *Membranes, Semipermeable membranes, Salt rejection, Membrane filters, Lithium, Sodium, Magnesium, Feasibility studies.

Theories proposed for the semipermeability of membranes in the past have all been based on cellulose acetate membranes, which are currently used for the treatment of effluents. This study investigated the feasibility of using a new type of hydrous zirconium oxide dynamically formed membrane in the reverse osmosis process. A cell was constructed to accommodate the membrane. Various experiments conducted with solutions of sodium chloride, lithium chloride, and magnesium chloride were designed to investigate membrane surface density, pressure and feed concentration variations, the effects of solute rejections, and water permeation across the membranes. The hydrous zirconium oxide dynamically formed membranes were found to be reasonably successful in obtaining salt rejection for the solutions tested. Salt solutions were rejected according to their molecular weights. Pressure increases from 200 to 800 PSI resulted in increases in the permeation rate for the three salt solutions tested. (Carroll-FRC)
W82-02382

MAIN COMPOUNDS BEHAVIOR IN KRAFT WASTES CLEANING BY ACID COAGULATION AND CARBON ADSORPTION,
Universidad Complutense de Madrid (Spain). Dept. de Quimica Industrial.
J. Aguado, J. J. Rodriguez, and J. Tijero.
Journal of Environmental Science and Health, Part A, Vol 16, No 4, p 405-418, 1981. 4 Fig, 1 Tab, 19 Ref.

Descriptors: *Pulp wastes, *Chemical coagulation, *Adsorption, Carbon, *Kraft mills, Industrial wastewater, *Wastewater treatment, Gels, Chromatography.

Kraft mill liquid wastes present many treatment problems and pose a significant threat to the environment. A treatment method developed by Vian and coworkers involves dividing kraft mill effluent into three waste streams based on their chemical compositions and treating the most problematic waste stream with acid coagulation at pH 4 followed by carbon adsorption. The waste stream, composed of wastewaters from the final steps of pulp washing, alkaline extractions from bleaching, and accidental black liquor overflows from the recovery section, includes lignin, alpha-cellulose and hemicellulose degradation products, and the remaining inorganics from white liquor. Acid coagulation reduces the concentration of lignin compounds considerably, but significant amounts of these compounds remain in solution. The precipitate from the coagulation treatment is comprised mostly of lignin compounds, with some adsorption of carbohydrates in the flocs. Partial acidolysis of large polymers occurs during either acid coagulation or redissolution with NaOH. Subsequent treatment by carbon adsorption drastically reduces the remaining lignin compounds, although carbohydrates are still present to some extent in the effluent from this treatment. Increasing the carbon dose results in substantially higher decreases in the final organic matter concentration. (Carroll-FRC)
W82-02383

THE EFFECT OF NITRIFICATION IN THE BOD TEST,
Anglian Water Authority, Petersborough (England). Petersborough Sewage Div.
P. G. Bird.
Water Pollution Control, Vol 80, No 3, p 378-389, 1981. 12 Fig, 2 Tab, 18 Ref.

Descriptors: *Nitrification, *Biological oxygen demand, Oxygen demand, Wastewater treatment, Water treatment facilities, Sludge, Bacteria, Acidity, Ammonia.

The five-day biological oxygen demand (BOD) test attempts to quantify the extent of the many different biochemical reactions which are taking place in the purification of water in a single test. In any BOD test, the basal oxygen demand will be provided by the oxidation of organic matter present by heterotrophic bacteria. However, contributions to the total oxygen demand may be expected from the oxidation of nitrogenous material by certain chemautotrophic bacteria; the magnitude of these contributions was investigated in this study. It was concluded that the extent of nitrification in the BOD test is dependent on the initial number of viable nitrifying bacteria. These bacteria will be associated with suspended particles in the sample. Nitrification proceeds more rapidly in the presence of suspended solids and heterotrophic bacteria. Under normal conditions, the difference between the normal BOD and the BOD(ATU) (allylthiourea) of the final effluent of a conventional biological filter sewage treatment plant can be small due to the long doubling period of the bacteria and the small number of viable nitrifying bacteria associated with the suspended solids. A partially nitrifying activated sludge sewage treatment plant will give large differences between the BOD and the BOD(ATU) due to the large number of viable nitrifying bacteria and the presence of significant amounts of ammonia. At periods during which the biological filter is sloughing off excessive growth, the difference would be high due to the large number of viable nitrifying bacteria associated with the suspended solids. The BOD test has been shown unsuitable for control purposes and unreliable when used for forecasting. The BOD test modified for suppressing nitrification is recommended for predicting the biochemical degradability of a sample.
W82-02384

DISPOSAL OF INDUSTRIAL EFFLUENTS - SOME FUTURE PROBLEMS,
Binnie and Partners, London (England).
G. E. Eden.
Water Science and Technology, Vol 13, No 7, p 337-346, 1981. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Wastewater treatment, *Industrial development, *Policy making, *Regulations, *Industrial wastewater, Environmental effects, Water resources development, Water quality management, Biological wastewater treatment, Environmental protection, Future planning, Industrial wastes, *United Kingdom.

In the United Kingdom, industrial effluents may be treated by individual industries before discharge into rivers or may be handled by local sewage treatment facilities. Organic materials of essentially natural origin and some synthetic organic materials may be handled by biological wastewater treatment processes. Toxic organics including pesticides and chlorinated solvents may be detrimental to biological sewage treatment operations and cause even greater problems when they appear in sludges. Inorganic compounds may be removed to some extent in the biological treatment of wastewater and also are present in sludges. National and international pressures are being exerted on the United Kingdom to change existing methods of waste water treatment. Some regional, national and international regulations that have been adopted as a result of these pressures are reviewed. The balance between environmental protection and the freedom to pollute is presently favoring the industrialists, who claim that too much restraint on industry will hamper manufacturing and economic prosperity. (Geiger-FRC)
W82-02405

BEDDINGTON SEWAGE-TREATMENT WORKS, CANYON: SOME OPERATING EXPERIENCES 1969-79,
Thames Water Authority, London (England).
D. I. J. Booker.
Water Pollution Control, Vol 80, No 3, p 356-377, 1981. 3 Fig, 7 Tab, 6 Ref.

Descriptors: *Wastewater facilities, Administration, Operating costs, Management planning, Primary wastewater treatment, Wastewater treatment, *England, Thames Water Authority.

Significant effects that have occurred since October of 1969 in the operation of the Beddington Sewage Treatment Works at Croydon are reviewed. The originally planned tertiary treatment plant has not been constructed. Flows resulting from the proposed closures of Sutton and Wandle Valley works have not been diverted to Beddington. Under specific conditions, flows from the works pumphouse and a pumping station on arrival at the works inlet tend to dam-off the sewage which flows by gravity from central and southern Croydon, causing this flow to back up and overflow the inlet weir of the inverted siphon which is intended to bring in gravity storm flows. This situation has been temporarily corrected through the raising of the inlet weir using a Coplastic sheet attached to brickwork, pending a permanent alteration of the weir level. The control system, governing the operation of duty pumps and capable of variable speed to deliver sewage at varying rates, proved very unreliable. Modifications found necessary for the pumping station included a piped supply of effluent under pressure to enable the pumps to be flushed out prior to maintenance and the re-routing of the discharge pipework from the sump of the dry well. The greatest changes since beginning operation have occurred in the sludge treatment and disposal system. A program of emptying and cleaning the digesters was begun in 1969-70, as they had not been cleaned out since start-up in 1936. An entirely new digestion plant was constructed. The new digesters operate on a draw and fill basis by remote control. Each tank was equipped with bubble guns for heating and mixing. These have not functioned well, as they frequently become blocked. Specific problems are also noted in the aeration plant, return-sludge pumping, final sedimentation, effluent recirculation, air supply and power generation.
W82-02410

UPWARD FLOW CLARIFICATION OF SECONDARY SEWAGE EFFLUENT USING LIME,
Portsmouth Polytechnic (England).
R. Irwin, B. A. Winfield, and P. A. Stead.
Effluent and Water Treatment Journal, Vol 20, No 5, p 222, 224, May, 1980. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Lime, *Clarifiers, *Wastewater treatment, Coagulation, Sedimentation, Tertiary wastewater treatment.

Lime coagulation in an upward flow, hopper-bottomed clarification unit was used to polish secondary effluents. The clarifier has a surface area of 1.56 sq meters and an overall depth of 2.13 meters. Lime is injected as a 0.1-1.0% calcium hydroxide suspension and forms a calcium carbonate floc. Suspended particles and other material are trapped as the water flows upward through the floc blanket. The continuously operating unit allows water to be drawn out at the top by a series of V-notched launders. Under almost all operating conditions studied, this clarification process removed twice as much BOD, suspended solids, and turbidity as did a normal sedimentation unit treating the same liquid. At lime doses of 100 mg per liter, up to 75% soluble P and 99% of coliforms were removed. Advantages of the process are small sludge volume, smaller tank volume, better effluent quality, and higher hydraulic loadings per unit surface area. (Cassar-FRC)
W82-02413

APPLICATION OF THE EXPANDED BED TECHNIQUE FOR THE DENITRIFICATION OF A SEWAGE EFFLUENT,
Thames Water Authority, London (England).
J. E. Hawkins, D. A. Stott, R. L. Stokes, and C. Clennett.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 361-373, July, 1980. 5 Fig, 3 Tab, 10 Ref.

Descriptors: Sewage treatment, *Denitrification, *Industrial wastes, *Flow discharge, *Streams, Nitrates, Runoff, Seasonal variation, Dilution, Hydrologic data, Oxidation, Fluidized bed process, *Wastewater treatment, Chemical analysis, Water pollution, Filtered wastewater.

The feasibility of using an expanded bed filter for denitrification of sewage effluent on a full scale is demonstrated. On the average the filter removed over 50 percent of the nitrate from a flow of 9000 m3 per day. The average rate of denitrification was 3.6 kilograms per cubic meter filter bed per day, while the average ratio of the weights of methanol consumed to nitrate removed was approximately

2.5:1. There were no significant instances of pollution of the river Lee due to the discharge of methanol from the works. The washing of the filter bed had to be carefully controlled to prevent clogging yet avoid excessive loss of biomass. (Titus-FRC)
W82-02436

AN EXPERIMENTAL PROJECT TO DETERMINE THE PARAMETERS OF SILICA SCALING IN REVERSE OSMOSIS SYSTEMS,
Coury and Associates, Inc., Lakewood, CO.
M. C. Mickley, and W. M. Straley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157942, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, 1981. 75 p, 30 Fig, 4 Tab. OWRT-C-90169-S(9526)(1), 14-34-0001-9526.

Descriptors: *Silica, *Scaling, *Reverse osmosis, Chemistry of precipitation, Metal complexes, *Silica scaling, Silica chemistry, Membrane scaling, Reverse osmosis systems, Silica solubility, Scaling mechanism kinetics, Silica precipitation, Silica supersaturation, Colloidal scaling, Silica complexing.

The objective of this work was to better define, on the basis of literature research and laboratory experiments in glassware and small reverse osmosis systems, how various parameters affect the concentration limits at which silica scaling occurs, and what the mechanisms of scaling are. The specific parameters studied were silica supersaturation, temperature, pH, and brine composition and concentration. Silica chemistry was found to be extremely complex, involving several different silica species and several mechanisms for removal of silica from solution. In addition, a wide variety of parameters were found to have effects on silica scaling, by affecting solubility, scaling mechanism, the kinetics of the mechanism, or a combination of these. This report provides a conceptual model of the types of silica scaling which may occur, and the situations in which they may occur, and presents experimental data consistent with the model.
W82-02451

EVALUATION OF MEMBRANE PROCESSES AND THEIR ROLE IN WASTEWATER RECLAMATION: VOLUME II,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-158007, Price codes: A12 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, November 30, 1980. 255 p. OWRT-C-80159-R(8520)(3), 14-34-0001-8520.

Descriptors: *Advanced wastewater treatment, *Wastewater renovation, *Water reuse, Reverse osmosis, Electrodialysis, Ultrafiltration, Ozonation, Costs, Water Factory 21, *Orange County Water District, California.

Water Factory 21 (WF-21) in Orange County, California, is a 15-mgd advanced wastewater treatment (AWT) plant designed to reclaim biologically treated municipal wastewater for injection into a seawater barrier system. Processes included are lime treatment, air stripping, filtration, activated carbon adsorption, reverse osmosis (RO), and chlorination. This study was undertaken because of increasing interest in use of reclaimed water to augment domestic water supplies. This report presents operating data from WF-21 collected during the second year of a three-year project. The effectiveness of each treatment process is presented, with emphasis on several AWT processes, including RO demineralization, ozone and biologically activated carbon, ultrafiltration, and electrodialysis. The data collected show that the combined processes, including RO, used at WF-21 are capable of producing a very high quality water. Treatment reduced all contaminants, with a very high degree of reliability, to levels below national interim primary drinking water regulation maximum contaminant levels. It was found that lime clarified secondary effluent can be used as feedwater to a RO demineralizer. This lime/RO process substantially reduces the pretreatment requirements and cost of reclamation. Experiments with new low pressure membranes (250 psi) show great potential for reducing RO costs. Pilot studies showed the membrane to be stable and not subject to rapid deterioration. The cost of AWT at WF-21 is $1,038 per million gallons. The cost of RO demineralization is $819 per million gallons. These costs include all operation and maintenance as well as amortization of capital.
W82-02457

IMPACT OF SUBURBAN RESIDENTIAL DEVELOPMENT ON WATER RESOURCES IN THE AREA OF WINSLOW TOWNSHIP, CAMDEN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 4C.
W82-02461

WASTEWATER MANAGEMENT IN COASTAL NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
R. J. Nierstedt, D. A. Okun, C. R. O'Melia, J. K. Sherwani, and M. S. Heath, Jr.
Water Resources Research Institute, University of North Carolina, Raleigh. Report No 165, December, 1980. 214 p, 13 Fig, 50 Tab, 15 Maps, 78 Ref, 23 Append.

Descriptors: *Wastewater treatment, Wastewater outfall, *Wastewater management, *Wastewater disposal, *Economic aspects, Ocean dumping, Coliforms, Waste disposal, Sewers, Aquatic environment, Federal jurisdiction, Cost-benefit analysis, Outfall sewers, Septic tanks, *North Carolina, Coastal zone management.

Rapid growth and development in coastal North Carolina, particularly as related to tourism and the building of second homes, have done serious damage to the aquatic environment. To assess options for sound wastewater management, two areas were selected for study: the Dare County area in the north, and the Carteret County area, with a small portion of Onslow County, in the south. The options examined were (1) discharge to inland coastal waters, (2) disposal on the land, and (3) discharge to the ocean. Ocean outfalls were found to be the best option because they exhibited economies of scale. Not only would disposal to inland waters be more costly than ocean disposal, but it would also pose a threat to shellfish growing areas. Land disposal is relatively safe, as long as care is taken to avoid contamination of potable water wells. Despite the high cost of sewerage for ocean disposal, this option is generally less costly than the others. Ocean disposal for the northern area can conveniently and economically serve the entire population. In the southern area, the mainland communities are so located that the most economical solution is a combination of an ocean outfall with land disposal for the inland communities. However, adequate data on the drift of wastewater with the currents and the dispersion of wastewaters in the offshore waters is not available. Length of outfalls and depths to place outfall dispersers must be conservatively determined. The report addresses issues of implementation and legal issues to be resolved. (Garrison-Omniplan)
W82-02511

RECYCLING,
North Carolina Department of Natural Resources and Community Development, Division of Environmental Management.
For primary bibliographic entry see Field 6E.
W82-02514

SOME ECONOMIC IMPACTS OF FRESHWATER STREAM EFFLUENT DISCHARGE LIMITS ON SELECTED SMALL COMMUNITIES IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Div. of Business Research.
L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157835, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Institute, Mississippi State University Report, September, 1981. 115 p, 27 Tab, 18 Ref. OWRT-A-131-MISS(1), 14-34-0001-1126.

Descriptors: *Federal Water Pollution Control Act, *Pollution abatement, Wastewater pollution, *Water pollution control, Water pollution sources, *Capital costs, Operating costs, Construction costs, Effluent streams, Industrial effluents, Sewage effluents, *Wastewater treatment, Secondary treatment, Pre-treatment, Sewage systems, *Mississippi, Effluent discharge limits, Regulations compliance costs, Public Law 92-500, Industrial profitability, Compliance impacts, Water pollution abatement regulations.

Wastewater effluent discharge limitations in Mississippi implemented under authority of Public Law 92-500 and other legislation, in general, have not produced compliance costs of a sufficient magnitude to affect the levels of employment, income, and output of the classifications of manufacturing firms incurring the largest costs. Capital expenditures for water pollution abatement, however, have been large enough to present a potential source for problems in selected firms in SIC groups 20, 22, 24, 25, 26, 28, 29, 30, 33 and 34. Firms in which compliance costs are most likely to affect profitability comprise only 3% of the state's manufacturing firms yet supply 10% of manufacturing employment and 15% of payrolls. Operating costs which result from compliance activities are far more significant to profitability than costs of compliance equipment. Compliance costs incurred by public sewage disposal systems in the state are having a much greater economic impact than industrial compliance costs. The most obvious effect is in the form of increases in system user rates. One reason regulations have not had more impact on industry is that over 90% are discharging some wastewater through public systems. Over 41% of surveyed system managers reported average household bills had already increased 100% or more because of construction costs and increases in operating costs.
W82-02530

WASTEWATER COLLECTION AND TREATMENT IN WAYNE COUNTY,
Wayne County Board of Public Works, MI.
R. E. Smith.
Water/Engineering and Management, Vol 128, No 9, p 41-42, 44, September, 1981.

Descriptors: *Rural areas, *Drains, *Wastewater facilities, *Costs, Wastewater treatment, Secondary wastewater treatment, Interceptor sewers, Flood control, Project planning, Administration, Financing, *Wayne County, Michigan.

As population shifted from the city of Detroit to rural areas, Wayne County, as suburb of Detroit, had to establish drainage districts to solve the sewerage problems of the new commjnities. Major projects which have been completed or are under construction include six drain projects and one treatment plant. These and other projects being handled under the supervision of the Wayne County Drain Commissioner's Office will cost a total of $270 million. Projects to prevent flooding are especially needed in the western, southeastern and downriver sections of the county. The estimated cost of all proposed projects is about $325 million. Community financing of such large projects is discussed. Cooperation between the Wayne County Drain Commissioner's Office, the Wayne county Department of Public Works and the Detroit Water and Sewerage Department helps in the managementof rural waste water problems. The Department of Public Works must remove three satellite plants from the Huron river and provide a facility for primary and secondary treatment to serve the growing populations of western and southern Wayne County. A 40 mgd waste water treatment plant is set to be constructed at the mouth of the Huron River. An interceptor to serve this facility will cost an estimated $250 million. Users should be assessed fees to assure that funds

are available to replace entire projects when their useful life has been exhausted. (Geiger-FRC)
W82-02554

ALGAL POLYMORPHISM IN HIGH RATE WASTEWATER TREATMENT PONDS,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
G. Oron, G. Shelef, and A. Levi.
Hydrobiologia, Vol 77, No 2, p 167-175, 1981. 2 Fig, 6 Tab, 26 Ref.

Descriptors: *Algae, *Wastewater lagoons, *Morphology, Wastewater treatment, Organic loading, Aeration ponds, Nutrients.

Two main algal species (Scenedesmus dimorphus and Micractinum) were found in high rate algae ponds used for wastewater treatment, effluent reclamation, and protein production. The external changes observed over a 3-year period were morphological, not species changes. These changes (colony separation, loss of setae, various types of aggregation, and changes in chloroplast distribution in the cells) were responses to variations in climate and operating regime, such as organic loading, retention time, aeration, mixing, radiation, ambient temperature, and effluent depth. Four forms of S. dimorphus were identified at different times: regular or classic, single cell (spring and summer), pseudo S. obliquus (late winter and early spring under overloaded conditions), and rounded single cell (under extended overload conditions). Micractinum also showed four forms: regular or classic M. pusillum and M. quadrisetum, floccy M. pusillum (under underloading conditions and nutrient shortage), and single cell M. pusillum (during overload conditions). (Cassar-FRC)
W82-02564

INFLUENCE OF DISSOLVED OXYGEN ON ACTIVATED SLUDGE VIABILITY,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
K. J. Williamson, and P. O. Nelson.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1533-1540, October, 1981. 6 Fig, 26 Ref.

Descriptors: *Biological wastewater treatment, *Model studies, *Dissolved oxygen, *Activated sludge, Wastewater treatment, Suspended solids, Sludge, Microorganisms, Mixed liquor solids, Volatile solids, Biological oxygen demand, Organic loading.

The specific viability of microorganisms in laboratory air and oxygen systems was measured by ATP methods to determine whether oxygen limitation occurs inside activated sludge flocs. Results of three separate experiments showed that increased dissolved oxygen (DO) levels of up to about 15 milligrams/liter in activated sludge yielded increases in viability, probably due to DO limitations inside flocs, changes in organism metabolism, or other factors. Increased viability can cause higher allowable food:microorganism (F:M) loadings while maintaining equal degrees of treatment if the F:M is determined from total volatile suspended solid levels and steady state solid retention times are greater than one day. At equal F:M ratios, the systems with greater viability will show significantly lower effluent substrate levels only at very short solid state retention times. At higher DO levels with increased endogenous respiration, lower sludge production occurs in activated sludge systems. A model of the activated sludge process which contains a nonviable component of the TVSS is presented. This can predict observed differences in ATP viability, allowable F:M loadings, and sludge production between air and oxygen systems. (Geiger-FRC)
W82-02582

CONCEPTS IN AQUATIC TREATMENT SYSTEM DESIGN,
Dewante and Stowell, Sacramento, CA.
R. Stowell, R. Ludwig, J. Colt, and G. Tchobanoglous.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 919-940, October, 1981. 5 Fig, 6 Tab, 45 Ref.

Descriptors: *Nutrient removal, *Wetlands, *Aquatic plants, *Wastewater treatment, Reviews, Nitrogen, Phosphorus, Aquatic animals, Aquatic environment, Biological oxygen demand, Effluents, Design criteria, Suspended solids, Bacteria, Viruses, Heavy metals, Organic compounds.

The present status of aquatic treatment systems (untreated wastewater applied to natural or man-made wetlands) is reviewed with respect to mechanisms and design. These systems are slower in action, use more land area, and are more subject to environmental influences than conventional treatment. A conceptual model for an aquatic processing unit is described. This combines plants (floating, emergent, and/or submerged) and animals (zooplankton and certain fish). Plant harvesting removes nutrients. Other factors to consider are climate (temperature, winds, and rain), unfavorable environmental effects (odor, fog, and disease), wastewater characteristics, and process reliability. Published data from 24 observations of operating aquatic treatment systems are presented. Generally, 80% of BOD can be removed at loading rates of 100 lb per acre per day. There should be about 8 inches of clear water between the root zone of floating plants and settled matter on the bottom. For emergent plants, water depth should be about 3 feet or less. The data available to date is insufficient to develop design criteria. Pilot plant tests and other investigative studies are necessary before any full-scale system is constructed. (Cassar-FRC)
W82-02593

THIOCYANATE BIO-OXIDATION KINETICS,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. D. Neufeld, L. Mattson, and P. Lubon.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE-5, p 1035-1049, October, 1981. 11 Fig, 1 Tab, 21 Ref.

Descriptors: *Thiocyanates, *Kinetics, *Wastewater treatment, *Coal gasification, Industrial wastewater, Aerobic treatment, Nitrogen compounds, Sulfur compounds, Ammonia, Sulfates, Biodegradation, Degradation, Activated sludge process, Biological treatment, Water pollution control.

A kinetic expression and material balance for nitrogen and sulfur was developed for biological degradation of thiocyanates in coal conversion process wastewaters. Batch and continuous culture experiments using an activated sludge system and thiocyanate-specific organisms showed that the specific utilization rate for thiocyanate degradation followed a substrate inhibition biokinetic relationship. The rate rose with increasing thiocyanate level to a maximum at about 470 mg per liter and decreased with a further increase in thiocyanate level. Critical sludge age was 4.14 days. Biodegradation of thiocyanate produced sulfate and ammonia. Thiocyanate removal at concentrations up to 1000 mg per liter was virtually complete in continuous culture systems at pH 5-7, but was poor at pH 8. (Cassar-FRC)
W82-02596

5E. Ultimate Disposal Of Wastes

ECONOMIC AND TECHNICAL EVALUATIONS OF SWINE MANURE MANAGEMENT SYSTEMS WHICH USE LAND APPLICATIONS,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
R. G. Drynan, J. C. Williamson, P. W. Westerman, and S. R. Crane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153727, Price codes: A09 in paper copy, A01 in microfiche.
Water Resource Research Institute, University of North Carolina, Report No 173, September, 1981. 174 p, 15 Fig, 62 Tab, 20 Ref. OWRT-A-098-NC(1), 14-34-0001-8035.

Descriptors: Agricultural wastes, *Animal wastes, Farm wastes, Economic evaluation, Land disposal, Waste management, Costs, *Cost analysis, *Land application, Agriculture, Hogs, *Manure, *Swine waste, Manure management alternatives, Least-cost system.

The trend towards more and larger confinement swine production operations has meant that larger quantities of localized manure have to be dissipated in cost-efficient and environmentally acceptable ways. Land application of the manure to agricultural crops represents an excellent manure utilization scheme as well as sound environmental management when application rates are based on crop nutrient requirements. Evaluations of which manure management alternatives for storage, treatment, handling and land applications are best for particular situations depend upon several factors, such as ease of management, labor constraints, capital available, land and crops available, and environmental considerations. Collection of waste management technical data and evaluation of the economics of the various feasible alternative manure management systems were the major objectives of this project. In this study, the major facilities, treatment, and land application options for liquid swine manure were identified and investment and operating costs were estimated. A mathematical integer linear programming model was developed to estimate costs of manure management systems and to determine which of the systems was the optimal or least-cost system. Also, subsidiary models were developed to compute various technical and cost coefficients for use in the main model. Examples include the model for calculating the time and labor requirements for spreading liquid manure with a tank wagon, and the model for determining the nutrients made available by manure applications at various times and rates.
W82-02175

SURFACE WATER HYDROLOGIC CRITERIA FOR URANIUM MINE TAILINGS IMPOUNDMENTS IN ONTARIO,
MacLaren (James F.) Ltd., Willowdale (Ontario).
C. T. Bishop, and R. Bishop.
Canadian Journal of Civil Engineering, Vol 8, No 3, p 364-369, September, 1981. 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Impoundments, *Design criteria, Uranium, *Radioactive wastes, Mine wastes, Mine drainage, Flood control, *Ontario.

The selection and implementation of surface water hydrologic criteria related to uranium tailings impoundments in Ontario were investigated. The mining and milling of uranium produces large quantities of low level radioactively contaminated waste rock, tailings, and process water. Regulatory agencies have set water quality standards for water discharged from tailings basins in Ontario. A closely monitored constituent of water from uranium tailings basins is radium. The existing hydrologic criteria for tailings impoundments in Ontario are rather vague. Existing guidelines do not stipulate a hydrologic criterion for the design of an emergency spillway specifically for this type of impoundment. Hydrologic criteria for such impoundments should be a function of the economic and environmental consequences of a failure. A guideline based on risk recognizes explicitly that a design flood of given return period bears a specific probability of beng equalled or exceeded during the service life of the mine. Hydrologic analysis of a tailings impoundment must determine values for the following parameters: the design treatment rate, the crest elevation of the emergency spillway, and the crest evaluation of other perimeter structures. The impoundment should be able to store and susequently treat all the runoff from the regional storms. The impoundment should be equipped with a spillway capable of passing the runoff from the probable maximum precipitation, assuming the water level prior to the storm to be equal to the mean annual level. (Baker-FRC)
W82-02240

MANAGING HAZARDOUS WASTES,

Weston (Roy F.), Inc., West Chester, PA.
P. B. Lederman, and M. D. LaGrega.
Industrial Wastes, Vol 27, No 5, p 36-38, 40, September/October, 1981. 2 Fig, 3 Tab.

Descriptors: *Water pollution prevention, *Landfills, *Waste management, Leachates, *Hazardous materials, Incineration, *Waste disposal, Solid waste disposal, Waste burial, Waste dumps, Chemical wastes, Industrial wastes, Organic wastes, Organic compounds, Land disposal.

Several methods of hazardous waste disposal are available for the interim period until the gap between waste disposal technology and new product development is narrowed. Landfills, land farming, and incineration are in widespread use in both acceptable and nonacceptable forms. Proper landfilling includes leachate management and monitoring, separation of noncompatible wastes, proper site selection (never penetrating an aquifer, and preferably not over a drinking water aquifer), and solidification of liquid wastes. Ordinary incinerators do not provide the 3-5 sec residence time and 2000 F temperatures necessary for complete waste destruction. Several good incineration systems are available: horizontal incinerators, multiple hearth, and rotary kiln. Land farming of wastes is successful if the site is actively plowed and not overloaded with respect to the material being dumped. The potential for groundwater contamination must be minimized by runoff control. Other methods of waste disposal in more limited use include waste reduction by modifying the manufacturing process, volume reduction of wastes (segregation of the most hazardous wastes from the innocuous material and concentration of liquids), chemical detoxification, and chemical destruction (hydrocarbons and chlorinated hydrocarbons). (Cassar-FRC)
W82-02252

INDUSTRIAL WASTEWATER PRETREATMENT SERVICE,
Chem-Clear, Inc., Wayne, PA.
J. K. Wittle, and B. W. Dunkel.
Industrial Wastes, Vol 27, No 5, p 46-49, September/October, 1981. 1 Fig, 2 Tab.

Descriptors: *Industrial wastewater, *Chemical wastewater, Wastewater treatment, Organic compounds, Chem-Clear Inc., Phenols, Chromium, Cyanide, *Wastewater disposal.

Chem-Clear, Inc., operates four regional facilities for pretreating liquid industrial wastes prior to disposal to sewers or landfills and detoxifies materials such as cyanide, hexavalent Cr, phenols, acids, and bases. There are six basic steps in the process: analysis of raw waste, primary settling, mixing and blending, chemical treatment, and dewatering/discharge. Safety precautions include earthen berms to isolate tank spills, large capacity emergency gasoline driven portable pumps, and treatment of floor spills. Pickling liquors and strong acids are neutralized. Cyanide is oxidized to the cyanate, which is further decomposed to CO2 and ammonia. Hexavalent Cr wastes are acidified and reduced to the trivalent state. Phenolic wastes are oxidized. The various pretreated wastes are combined for a chemical treatment which occurs in seven individual compartments. Resiting sludge is dewatered in a filter press and landfilled. Clarified effluent is discharged to the municipal sewer system according to the effluent limitations and hours specified by the local sewer district. Waters containing the following materials are not accepted for treatment: pesticides, insecticides, polychlorinated biphenyls, and PBB's. (Cassar-FRC)
W82-02253

ANALYSIS OF ROCK STRESS AROUND A LIQUID WASTE INJECTION SYSTEM IN ILLINOIS,
Kansas Univ., Lawrence.
M. Heidari, and K. Cartwright.
Water Resources Bulletin, Vol 17, No 4, p 614-622, August, 1981. 6 Fig, 15 Ref.

Descriptors: *Injection wells, *Underground waste disposal, *Stress analysis, Stress, Rocks, Aquitards, Aquifer management, Water quality, Mathematical studies, Hydraulic fracturing.

A simple analytical solution to the transport equation was used to investigate the injection of liquid industrial wastes into deep subsurface formations. The problem of lateral movement of injected fluid due to dispersion, diffusion, and convection was investigated, and dispersion and diffusion were found to be of minor importance. Convection was the major transporting agent, and its effects can only be evaluated after a long period of injection. Stress distribution in the vicinity of the well may be the cause of hydraulic fracturing of the aquitards, which would threaten aquifers containing potable water. A disposal well in Putnam County, Illinois, was simulated to demonstrate stress around the well, and stress was found to be below the danger point after long, continuous injection. (Small-FRC)
W82-02280

PVC COVER CAUSES LEACHATE RETREAT,
SMC-Martin, King of Prussia, PA.
G. H. Emrich.
American City and County, Vol 96, No 10, p 61-62, October, 1981. 2 Fig.

Descriptors: *Groundwater pollution, *Water pollution control, Water pollution sources, Plumes, Landfills, Waste dumps, Leachates.

Groundwater was contaminated by leachate from an illegal dump in the area of Windham, Connecticut. Further downgradient and threatened by the leachate was the reservoir that supplied drinking water to portions of the town of Windham, as well as to the entire city of Willimantic, which lay within the town boundaries. The state ordered the landfill closed, and an infiltration-preventing closure was to be designed. Regrading was done such that runoff from the surface of the hill was maximized and a minimum of about a foot of material was left atop all wastes. Atop the native soil was placed a minimum of four inches of washed fine sand. The entire top of the landfill was next covered with a 20-mil layer of polyvinyl chloride. Groundwater samples were collected and the specific conductivities determined before and after application of the seal. According to the initial conductivity contour map, a major contamination plume was moving toward the reservoir. One year after seal placement, measurements showed that the plume had receded. (Baker-FRC)
W82-02321

EFFECT OF THE EARTHWORM, EISENIA FOETIDA (OLIGOCHAETA), ON FLUXES OF VOLATILE CARBON AND SULFUR COMPOUNDS FROM SEWAGE SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
S. G. Hornor, and M. J. Mitchell.
Soil Biology and Biochemistry, Vol 13, No 5, p 367-373, 1981. 2 Fig, 3 Tab, 33 Ref.

Descriptors: *Activated sludge, *Decomposition, *Oligochaetes, Sludge disposal, Land application, Sulfur compounds, Macroinvertebrates, *Earthworms, Bacteria, Anaerobic bacteria, Methane bacteria, Odor control, Aerobic treatment, Biodegradation, Organic compounds, Nitrogen compounds, Hydrogen sulfide, Sulfides, Feces, Moisture content, Soil amendments, Mineralization.

Activated sludge was fed to earthworms, Eisenia foetida, to determine the effects on aerobic decomposition. Rates of decomposition were measured by flux rates of gases in undigested and digested sludge. Feces always showed higher fluxes of CO2 and O2 and lower fluxes of methane, H2S CH3SH, and (CH3) 2S than undigested sludge, indicating that earthworm feeding stimulated aerobic decomposition of sludge. Gas flux rates for CO2 and O2 in both sludge and feces were directly proportional to their moisture content. Methanogenesis never accounted for more than 0.06% of the gas atmosphere, an indication of aerobic respiration. Volatile sulfur accounted for 0.02-0.08% of total S present. CH3SH and (CH3) 2S evaluation from feces were significantly correlated with moisture content. H2S accounted for 97-100% of total evolved S from sludge and a lesser percentage from feces. Earthworm feeding or moisture content did not affect populations of total anaerobes, nitrate reducers, sulfate reducers, and methanogens. Malodorous S compounds were less noticeable when feeding earthworms partially dried sludge, but sludge of > 3:1 moisture to dry weight ratio could stimulate volatile S production. (Cassar-FRC)
W82-02362

REDUCING GROUND-WATER POLLUTION FROM MUNICIPAL WASTE-WATER IRRIGATION OF RHODES GRASS GROWN ON SAND DUNES,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).
For primary bibliographic entry see Field 3C.
W82-02391

AN INVESTIGATION OF THE INFLUENCE OF BACTERIOPHAGES ON THE BACTERIAL FLORA AND PURIFICATION POWERS OF ACTIVATED SLUDGE,
Kyushu Univ., Fukuoka (Japan). Dept. of Agricultural Chemistry.
S. Ogata, H. Miyamoto, and S. Hayashida.
Journal of General and Applied Microbiology, Vol 26, No 2, p 97-108, April, 1980. 8 Fig, 3 Tab, 9 Ref.

Descriptors: *Activated sludge, *Bacteria, *Biochemical oxygen demand, *Seasonal variation, *Sewage, Bacteriophage, Incubation, Temperature effects, Air temperature, Sedimentation rates, Viruses, Morphology, *Wastewater disposal.

Bacteriophages in the activated sludge of a public sewage disposal plant were isolated, and the influence of the phages on the bacterial flora and the purification powers and sludge volume index of the sludge were examined. Two groups of dominant bacteria were isolated during a 30 month investigation. At the time of the isolation, a disturbance in the normal bacterial flora was observed. Such disturbance was considered to cause a decrease in the purification powers. The disturbances occurred in spring and autumn, and may be caused by phage infection. (Titus-FRC)
W82-02433

THE DESIGN OF SEA OUTFALLS WITH REFERENCE TO EEC AMENITY WATER POLLUTION CRITERIA,
Dundee Univ. (Scotland). Dept. of Civil Engineering.
J. A. Charlton.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 33-41, January, 1980. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *Seawater, *Water pollution, *Outfalls, *Effluent limitations, *Beaches, Design criteria, Wastewater outfall, Outfall sewers, Bacteria, Sewage, Water quality, Tidal effects, Environmental effects, Coastal waters, Turbulence, Dispersion, Swimming, Public health, Great Britain, Europe.

Water quality criteria for bathing waters are discussed. The criteria were established by the European Economic Community (EEC), and are intended for use in the design of sea sewer outfalls. Meteorological data are analyzed to determine threshold wind conditions corresponding to the exceedance percentage. In situ current and dispersion studies are then used to establish dilution rates and normal boundaries, which are then wind shifted to their limiting position. These boundaries must remain clear of the bathing area for the outfall design to be acceptable. Additional precautions are recommended for the discharge of industrial effluents. (Titus-FRC)
W82-02449

TREATED PIT FLUIDS MEET WATER SPECIFICATIONS.
Oil and Gas Journal, Vol 78, No 48 p 138-139, December 1, 1980.

Descriptors: *Pit recharge, *Drilling fluids, Wastewater treatment, *Drilling, Clarifiers, Industrial wastes, *Waste disposal.

The need to haul reserve pit fluids used in land drilling and workover operations to another location in a vacuum truck or find a suitable subsurface disposal site can be eliminated through the chemical and mechanical treatment of the fluids. Treatment is practical during drilling or after the rig moves off location. After treatment the fluids to meet water quality standards, the effluent can be discharged into surface waters or natural drainage. Remaining solids are backfilled or buried for disposal. Most jobs have certain common characteristics. The average pit has 20,000 to 30,000 bbl of effluent, of which 60-90% can be discharged. Pits included contaminated rain water, wash down and drilling wastes. The least expensive treatment of this type to date costs 10 cents/bbl, and the most expensive costs $1/bbl. Average treatment cost is in the range of 40-50 cents/bbl. The customer is charged only for the clean water measured upon discharge. The average job requires about 3 days. The bioassay for water quality involves placing 12 medium tolerant bait fish is a 100% concentration of the treated effluent for at least 24 hr. If 70% survive, discharge is allowed at a specific rate. Equipment needed includes large centrifugal pumps for transferring water, chemical mixing tanks with 1,000-2,000 gal capacity, and chemical lines and hoses. Clarifiers and centrifuges are used for extremely tough jobs. (Baker-FRC)
W82-02557

SLUDGE: BACK INTO THE OCEAN,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 53, No 10, p 1442-1446, October, 1981.

Descriptors: *Sludge disposal, *Ocean dumping, *Legal aspects, *Environmental effects, Wastewater treatment, Wastewater disposal, Waste disposal, Land disposal, Outlets, Waste management, Recycling, Waste recovery, Permits, Jurisdiction, Regulations, Water pollution effects, Ecological effects.

The issue of the ocean dumping of sludge has been reviewed by the U.S. courts. Much overlap exists when regulating the ocean dumping of wastes; the principal legislation is included under the Marine Protection, Research, and Sanctuaries Act (MPRSA), the Federal Water Pollution Control Act (FWPCA), and regulations of the Army Corps of Engineers, EPA, and the National Oceanic and Atmospheric Administration (NOAA). The production of waste water sludge by the nation's publicly owned treatment works is expected to nearly double by 1990. The role of the MPRSA, the politics of ocean dumping, and some environmental effects of ocean dumping are considered. NOAA has extensively studied the New York Bight in connection with ocean dumping and favors ocean dumping of sludge only when it is the most favorable option. The advisory committee to this agency supports the reuse and recycling of wastes as a priority goal for sludge disposal. Two cases which came up in court concerning the EPA regulations and ocean dumping are examined. In June of 1981, President Reagan authorized increased research on ocean dumping under MPRSA. NOAA intends to sponsor with EPA projects that will assess the relative risks posed to the environment by various ocean dumping options and develop new strategies for ocean dumping. (Geiger-FRC)
W82-02577

5F. Water Treatment and Quality Alteration

TRIHALOMETHANE FORMATION IN NORTH CAROLINA DRINKING WATERS,
North Carolina Univ. at Chapel Hill. School of Public Health.
For primary bibliographic entry see Field 5B.
W82-02195

PROCESSES--NOT PRODUCTS--BIGGEST ENERGY-SAVING FACTORS.
For primary bibliographic entry see Field 5D.
W82-02218

CHEMICAL PRETREATMENT FOR ACTIVATED-CARBON ADSORPTION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
S. J. Randtke, and C. P. Jepsen.
Journal of the American Water Works Association, Vol 73, No 8, p 411-419, August, 1981. 17 Fig, 3 Tab, 36 Ref.

Descriptors: *Water treatment, *Activated carbon, *Adsorption, Water treatment facilities, Drinking water, Potable water, Coagulation, Chemical coagulation, Groundwater, Fulvic acids.

A research project was undertaken to investigate the removal of organic contaminants by coagulation and softening and to explore the interactions of these processes with subsequent activated-carbon adsorption. The results of this project are reported as they relate to the removal of organic contaminants by metal-salt coagulation and the effects of coagulation and softening on activated-carbon adsorption. Five sources of organic matter were used: a local groundwater supply, a humic acid, and three preparations of fulvic acid. The effectiveness of the removal process was related to the dosage of coagulant relative to the amount of organic matter present, the inorganic composition of the water, and the type of organic matter present. The predominant mechanism for organic matter removal by coagulation appeared to be the precipitation of insoluble organo-aluminum complexes. Pretreatment by coagulation significantly increased the adsorptive capacity of activated carbon for the remaining total organic carbon, except when little or no total organic carbon removal occurred during the coagulation process. This increase was not an artifact, but was primarily the result of an interaction between aluminum species and the organic molecules. A minor portion of the increase was attributable to a decrease in the initial total organic carbon concentration for the adsorption process. Neither coagulation nor softening preferentially removed either strongly adsorbing or weakly adsorbing organic molecules. (Baker-FRC)
W82-02234

NEW JERSEY COMMUNITY DECONTAMINATES WELL WATER.
Water Well Journal, Vol 35, No 9, p 58-59, September, 1981.

Descriptors: *Well water, *Decontamination, Adsorbents, Carbon, Water treatment facilities, Organic compounds, *Industrial wastes, Activated carbon, Potable water, Groundwater pollution, Trichloroethylene, Tetrachloroethylene, *Rockaway Township, *New Jersey.

Rockaway Township discovered in the fall of 1980 that all three of its public wells were contaminated with hazardous organic chemicals. A granular activated carbon system was installed in November of 1980 to treat its groundwater. Tetrachlorethylene was found in the groundwater pumped from all three wells. Well number 1 had levels as high as 650 ppb. Another well was also contaminated with 40ppb trichlorethylene. Granular activated carbon removes dissolved organic pollutants from water by a process of adsorption. As water passes through the porous granules of activated carbon, molecules of the organic pollutants are attracted to the surface of the pores and are held there by weak physical forces. The ability of granular activated carbon to remove large quantities of organic impurities is a function of its highly developed internal pore structure, which is created during the manufacturing process. A single handful of activated carbon has a total surface area equal to that of a football field. After the carbon has adsorbed all it can, it is reactivated through treatment in a multiple-hearth furnace. The organic impurities are burned from the internal surfaces of the individual carbon granules. More than 90% of the original carbon is recovered in the reactivation process. Rockaway Borough has also received cooperation from the state in attempting to locate the source of the contamination. (Baker-FRC)
W82-02243

SEASONAL EVALUATION OF ORGANICS REMOVAL AT A CONVENTIONAL WATER TREATMENT PLANT,
CH2M Hill, Reston, VA.
B. Gong, and J. K. Edzwald.
Aqua, No 4, p 0300-0304, 1981. 12 Fig, 4 Tab, 2 Ref.

Descriptors: *Water treatment facilities, *Seasonal variation, Organic compounds, Trihalomethanes, *Organic matter, Rivers, Grasse River, Raw water.

The seasonal variation of organic matter and trihalomethane (THM) precursors were studied in a raw river water supply. Seasonal performance of a conventional water treatment plant was also investigated with regard to the removal of organic matter and THM precursors. The correlations between terminal total trihalomethanes (Term-TTHMs) and surrogate parameters such as non-volatile total organic carbon, UV, absorbance, and color were also investigated. The water supply studied was the Grasse River at Canton, New York. The River is characterized by low turbidity, low alkalinity, and colored surface water. Raw water was collected on nine occasions between January 1980 and October 1980. Process samples were collected at five locations from the Canton water treatment plant. A definite seasonal trend in organic matter and THM precursors was noted in samples taken from the Grasse River. The lowest concentrations for non-volatile total organic carbon and TTHM formation potentials occurred in the winter when the river was covered with ice. The highest concentrations were noted in late July and August. The Canton water treatment plant was found to be performing well with regard to removal of non-volatile total organic carbon and THM precursors, with average removals of 66 and 68% being noted. The Canton plant uses alum coagulation with a nonionic polymer to aid floc formation. Pre-chlorination is practiced. An important characteristic of the plant is the short hydraulic detention time through the treatment plant, which is about 1 hr. This allows THM precursors to be removed prior to THM formation. Apparent color proved to be a gross measure of naturally occurring organic material in rivers. It also had good correlation with Term-TTHMs. (Baker-FRC)
W82-02248

SPECIFIC ORGANIC REMOVALS BY GRANULAR ACTIVATED CARBON PILOT CONTACTORS,
Philadelphia Suburban Water Co., Bryn Mawr, PA.
T. L. Yohe, I. H. Suffet, and P. R. Cairo.
Journal of the American Water Works Association, Vol 73, No 8, p 402-410, August, 1981. 16 Fig, 6 Tab, 27 Ref.

Descriptors: *Water treatment facilities, *Activated carbon, *Organic compounds, Chloroform, Philadelphia, Drinking water, Potable water, Water treatment.

The behavior of granular activated carbon during removal of specific organics from drinking water is discussed. Data are taken from a 15 week pilot study designed to ascertain the effects of aqueous chlorine on the GAC adsorption unit process. More than 100 specific organics were followed. For five specific compounds, the effects of mechanisms of surface oxidation and adsorption are detailed. These five compounds are chloroform, p-dichlorobenzene, 1,2-bis-(2-chloroethoxy)ethane, diacetone-L-sorbose, and dibutyl phthalate. The study showed that the concentrations of trace organics in Philadelphia drinking water fluctuate greatly. When applied to carbon filters these variable influents are reflected in the carbon beds and ultimately in the effluents. Pilot column effluent concentrations can exceed and have exceeded influent levels. Chloroform precursors exhibit adsorption behavior independent of the adsorption behavior exhibited by the surrogate total organic carbon parameter. Organics present in concentrations less than 1 microgram per liter are subject to displacement-desorption from GAC. Chlorine changes GAC properties chemically, physically,

and biologically. The greatest changes occur in uppermost bed regions, where chlorine increases surface oxides on the GAC. Alterations of upper bed properties appear to influence adsorption and subsequent desorption by creating broader initial adsorption bands. This results in broader readsorption bands within the column and causes initial breakthrough to be attenuated due to less severe displacement; this can slough a larger mass to the column effluent. (Baker-FRC)
W82-02260

HOW COMPUTERS HAVE CHANGED WATER WORKS OPERATIONS,
Water and Pollution Control, Vol 119, No 7, p 22, 31, 32, July, 1981.

Descriptors: *Water management, *Computers, Water supply, Toronto, Municipal water, Monitoring, Drinking water, Management, Decision making, *Water distribution, *Automation.

The amount of data required to efficiently operate a water works utility has made the use of computers for process control very appropriate. Practical installations in this area of distribution system operation began about 15 years ago. Central pumping control is a supervisory system operated over Bell Telephone signal circuits to monitor pumping stations and the distribution system and determine the status of valves, pumps and power supplies, reservoir levels, suction, discharge and district pressures and flows. It provides printouts of the data for the operator's information. New stations, when built, can be readily added to existing computer networks. The system as employed in Metropolitan Toronto is at present, due to age, showing signs of potential malfunction, and a new computer and updating of the supervisory system are planned. The process control computer serves to alert the operator immediately by means of an alarm display and with a hard copy alarm printout of any unusual occurrences in the plant's operation. The memory allows the creation of permanent records. Operators have communication with the computer through the operating console. Pushbuttons are presently dedicated to such items as level, flow,pressure, turbidity, chlorine residual and others of significance for water plant operations. The Metropolitan Toronto system has four filtration plants, currently undergoing computerization. (Baker-FRC)
W82-02276

PILOT-SCALE INVESTIGATIONS WITH GRANULAR ACTIVATED CARBON,
Thames Water Authority (England).
For primary bibliographic entry see Field 5D.
W82-02289

DETERMINING MAXIMUM INFLUENT CONCENTRATIONS OF PRIORITY POLLUTANTS FOR TREATMENT PLANTS,
Enviroscience Inc., Minneapolis, MN.
For primary bibliographic entry see Field 5A.
W82-02307

COST OF SMALL WATER SUPPLY TREATMENT SYSTEMS,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, and J. M. Morand.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1051-1065, October, 1981. 4 Fig, 12 Tab, 10 Ref.

Descriptors: *Cost analysis, *Water costs, *Water supply systems, *Water treatment, Water quality, Package plants, Reverse osmosis, Ion exchange, Maintenance costs, Operating costs, Technology, Chlorinated hydrocarbons, Trihalomethanes, Heavy metals, Metals, Turbidity, Water softening, Water treatment facilities.

Three water treatment alternatives for small systems are compared: conventional (flocculation, sedimentation, and filtration), direct filtration (without sedimentation), and package plants. Conventional treatment production costs were highest and package plants lowest up to 2 mgd. Direct filtration costs were lowest from 2 to 5 mgd. Costs of conventional treatment and package plants were equal at 9.5 mgd. 19 municipal and 17 recreational package plants were studied in Kentucky, West Virginia, and Tennessee. Coliforms were detected at 3 of 31 plants; 8 did not meet the 1 NTU turbidity standards; and 5 of 31 exceeded the 100 micrograms per liter total trihalomethanes standard. Pesticides were not detected in any samples. Heavy metals were detected in a few samples, in small concentrations except for a 19.6 microgram per liter Hg level in one sample. Other possible treatment methods for small systems (0.5 to 2.0 mgd) are (in decreasing order of cost): reverse osmosis, conventional treatment with softening, package plants with softening, and ion exchange with softening. At very small flows, reverse osmosis ranks third in cost, whereas at very high capacity, ion exchange becomes more expensive per unit. Still another possibility for reducing water costs in small communities is to form a regional compact. (Cassar-FRC)
W82-02318

WATER CLARIFICATION AND DECOLORIZATION WITH REGENERABLE MAGNETIC PARTICLES,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
D. E. Weiss, and W. G. C. Raper.
Effluent and Water Treatment Journal, Vol 21, No 8, p 359-363, 365, 366, August, 1981. 3 Fig, 6 Tab, 11 Ref.

Descriptors: *Clarification, *Water treatment, Clarifiers, Turbidity, Color removal, Iron compounds, Drinking water.

Magnetic materials have recently been incorporated into alum flocs, which may then be removed by means of a high gradient magnetic separator. Once it was understood that color and turbidity could be removed from water using performed particles, which were initially magnetic ion-exchange resins in a positively-charged form, a cheap magnetic particle was sought with the surface charge needed for removing impurities from water. A reversible positive charge was needed to allow regeneration and recycling. Ferric hydroxide coated onto very fine particles of magnetic ore was shown to perform well and was regenerable by treatment with hydroxide solution. However, it was not suitable for prolonged use. A very fine magnetite ore alone, after treatment with sodium hydroxide, was then used as an effective remover of color and turbidity. The surface charge is reversible under alkaline conditions to regenerate the particle for reuse. To achieve the charge reversal needed for regeneration, calcium must not be added in the alkaline stage. Hence, caustic soda rather than lime is employed as the regenerant. Laboratory and pilot plant tests using the principles outlined above are reported. The results of water quality tests at the highest rate tested to date, 25 Ml/d, indicate that turbidity has been lowered from 15 NTU to 0.6-1.0 NTU; color from 45 PT-Co to 3.5-5 PT-Co; total soluble iron from 3 mg/l to 0.04 mg/l; and hydrogen sulfide from 1 mg/l to a negligible amount. (Baker-FRC)
W82-02351

DETECTION OF CHLOROFORM IN THE TISSUES OF FRESHLY EVISCERATED POULTRY CARCASSES EXPOSED TO WATER CONTAINING ADDED CHLORINE OR CHLORINE DIOXIDE,
Agricultural Research Council, Norwich (England). Food Research Inst.
For primary bibliographic entry see Field 5A.
W82-02374

OPTIMIZING COAGULANTS AND FLOCCULANT AIDS FOR SETTLING,
Servico de Engenharia Emilio Baumgart Ltd., Belo Horizonte (Brazil).
J. R. Bratby.
Journal of the American Water Works Association, Vol 73, No 6, p 312-318, June, 1981. 10 Fig, 3 Tab, 10 Ref.

Descriptors: *Alum, *Coagulation, *Flocculation, *Water treatment, Nalco 8182, Turbidity, Settling velocity, Costs, Polyelectrolytes, Brazil, Pilot plants.

A method for choosing an optimum primary coagulant dosage, applied alone or with flocculant aids, is illustrated using raw water from Lago Descoberto, the water supply for the city of Brasilia. Preliminary studies showed that alum was the most desirable primary coagulant. A set of curves was developed to relate the overflow rate and coagulant dosage for the effluent qualities, 0.5, 0.6, 0.7, and 0.8 ftu, using raw water of average 3,24 ftu. Using the present worth method by Pilcher and considering costs of alum, costs of lime required to maintain optimum pH, and capital costs, the optimum dosage for alum alone was calculated at 15 mg per liter, with settling as the solid-liquid separation option. However, when flocculant aids are also used, the primary coagulant dosage is considerably lower. For determining optimum dosages in this case, the clogging of the filter surface, rather than costs, is the major consideration. Pilot plant experiments with 14 flocculants resulted in an optimum dosage of 3 mg per liter alum and 0.15 mg per liter polyelectrolyte (Nalco 8182) at pH 6.4. Total chemical costs using this treatment were estimated at 4.5 million Cruzeiros a year. (Cassar-FRC)
W82-02409

JONKOPING'S WATER SUPPLY,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden). Water and Environment Engineering Dept.
S. Bergling.
Aqua, No 4, p 3-5, 1981. 5 Fig.

Descriptors: *Water treatment facilities, *Lakes, Drinking water, Reservoirs, *Lake Vattern, *Sweden, Jonkoping, Filtration, Chlorination, Ammonia, Water supply.

Jonkoping is situated on the southern end of Lake Vattern, Sweden's second largest lake, with a surface area of almost 2000 square kilometers, an average runoff of 35 cubic meters/second, and a total water volume of about 70,000 million cubic meters, corresponding to an average water period of about 60 years. This long detention period is one of the major factors in the high quality of water, with low plankton content and an average water transparency of 12 meters in the lake. Except for a combination of technical factors and the general conditions prevailing during the mid-nineteenth century, Jonkoping's water supply would have been based on this lake. In 1953 investigations regarding Jonkoping's future water supply proposed a new water treatment plant, to be sited on the west bank of the lake at Haggeberg, 1 km north of the Eklundshov plant, with sufficient capacity to meet the water demands of the entire town. Water was to be abstracted from the lake at such a depth that temperature variations would be minimal, and that treatment should consist of slow sand filtration, followed by alkalinization with lime water and chlorination accompanied by ammonia dosing. The plant became operational in 1957. The major parts of the plant include the lake water intake, lake water pipe, lake water pumping station, lake water pipe to slow sand filters, slow and filtration unit, low level reservoir sited in rock, drinking water pumping plant sited in rock, high and low voltage equipment, standby power plant, and main pipe to town. Slow sand filtration has proved an effective method of treatment, and an estimated filter speed of 0.30 meters/hr has been maintained. Long-term expansion of the Haggeberg plant is discussed. (Baker-FRC)
W82-02419

NEW EUROPEAN EXPERIENCES IN REMOVAL OF ORGANICS IN SURFACE WATER TREATMENT,
Water Supply, Zurich (Switzerland).
M. Schalekamp.
Aqua, No 4, p 0279-0289, 1981. 6 Fig, 12 Ref.

Descriptors: *Water treatment, *Quality control, Flocculation, Filtration, Adsorption, Lakes, Chlorination, Ozonation, Disinfection, Chlorine dioxide, *Switzerland.

Increased pollution of the environment has forced water treatment authorities in Switzerland to take further measures to protect and improve the quality of water being supplied to the citizens. Lakes in the area have passed from oligotrophic conditions to eutrophic ones. International cooperation has been good on improving matters concerned with the Rhine. Waterworks on the Lower Rhine have used practically all available possibilities for water treatment, including river bank filtration, ozonation, multi-layer filtration, GAC-filtration, neutralization and safety chlorination. In the future the following treatment processes will be employed on Swiss lake water plants: prechlorination, flocculation, double-layer rapid filtration with sand and pumice, neutralization, ozonation, GAC filtration, slow sand filtration and chlorine dioxide treatment. On practically every Swiss lake which is being used for drinking water production, the new treatment technique is already in operation or will shortly be in operation. The addition of chlorine dioxide does not act as an actual water treatment, but does serve as pipeline protection so that the water in the supply and distribution network remains hygienically perfect. The dosage is only 0.05 mg of chlorine dioxide per liter, so no difficulties arise with chlorite and chlorate. This entire cleaning process reduced organic substances by 90%, allowing a very high standard of water quality to be attained. Further work is now in order on wastewater cleanup. (Baker-FRC)
W82-02420

WATERBORNE DISEASE IS PREVALENT IN EGYPT,
For primary bibliographic entry see Field 5C.
W82-02435

REDUCING PLUMBOSOLVENCY - THE EFFECT OF ADDED LIME ON THE LOCH KATRINE SUPPLY TO GLASGOW,
Strathclyde Regional Council (Scotland).
W. N. Richards, A. Britton, and A. Cochrane.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 315-333, July, 1980. 11 Fig, 4 Tab, 21 Ref.

Descriptors: *Solubility, *Lead, *Drinking water, *Glasgow, Scotland, Hydrogen ion concentration, *Water treatment, Lime, Alkalinity, Water supply, Corrosion, *Pipes.

Increasing the pH of Loch Katrine reservoir waters from 6.3 to 7.8 by the addition of lime has reduced the plumbosolvent nature of the water. The addition of lime has increased the number of random daytime samples complying with the international health standards for lead of 0.1 mg per liter from less than 50 to over 80 percent. Unsatisfactory samples continue to be obtained from premises with lead lined storage tanks, properties with copper to lead runs of piping, properties built before 1919, and properties with a single occupant. Lead solubility calculations indicate that further reductions in plumbosolvency should be possible if high pH values can be maintained at consumers' taps. (Titus-FRC)
W82-02446

PH CORRECTION: TECHNICAL ASPECTS OF A 500 TCMD TREATMENT WORKS,
Quest Automatron Research, Ltd., Dorset (England).
P. L. G. Pharaoh.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 4, p 334-345, July, 1980.

Descriptors: *Hydrogen ion concentration, *Water sampling, *Water treatment, *Water supply, Chemical analysis, Lead, Contamination, Technology, Solvents, Economic effects, Engineering, Storage, *Lime, Flow discharge, Chlorination, Electronic equipment, Design criteria, Design standards.

Electronic control was capable of maintaining the desired pH level by liming during major fluctuations of the slurry solution strength in a water treatment plant in Glasgow. Control and instrumentation in general proved to operate well within the initial specifications. Step functions induced in the control system either by manual means or by sudden high flow rates can be countered by the three term controllers and the swift response of the stroke and speed control equipment to the pumps. This system has enhanced plant operation and maintenance as well as reducing the incidence of blocked pipes normally experienced in other works in the region. (Titus-FRC)
W82-02447

THE INTEGRITY OF EXISTING DISTRIBUTION SYSTEMS,
Severn-Trent Water Authority (England).
D. W. Lackington, and J. M. Large.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 15-32, January, 1980. 12 Fig, 8 Ref.

Descriptors: *Distribution, *Water supply, *Drinking water, *Statistical models, *Pipelines, Sewers, Cost analysis, Corrosion, Deterioration, Monitoring, Maintenance, Boreholes, Chemical properties, Water treatment, Engineering, Technology, Climate data, *United Kingdom.

The integrity of the Leicestershire water distribution network is evaluated. A variety of parameters affecting the Leicestershire network were monitored. Investigations so far indicate that problems of burst frequency, discolored water, low residual pressure, and, to some extent, waste water are linked. The common factor is corrosion of unlined iron mains. This situation appears to be aggravated when new waters are introduced into old mains. Chemical treatment adding sodium silicate at the source is not considered a suitable alternative to physical repair of the network. (Titus-FRC)
W82-02450

METHODS FOR TREATMENT OF COLOR IN GROUNDWATER,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
G. F. Mitchell, and D. O. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157850, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University. Report, September, 1981. 87 p, 43 Fig, 25 Tab, 61 Ref. OWRT-A-132-MISS(2), 14-34-0001-1126.

Descriptors: Ion exchange, Membrane processes, Oxidation, Coagulation, UV-radiation, Adsorption, *Color removal, *Groundwater, *Water treatment, Strong base ion exchangers, Weak base anion exchangers, Ultrafiltration, UV-radiation.

Ion exchange, ultrafiltration, coagulation, oxidation and other techniques were investigated for treatment of a groundwater containing organic color in the range of 20 to 60 units as platinum cobalt. Treatment with coagulation was often incomplete and required high dosages of coagulates. Oxidation was generally ineffective except with uv-radiation and hydrogen peroxide. Ultrafiltration was effective with a UM type membrane of 10,000 molecular weight cutoff providing over 90 percent color removal. A commercially available PM type membrane did not provide this removal except with pH adjustment of the feed to 5. Color removal was affected by membrane characteristics. Ion exchange on a macroporous strong base anion exchanger provided excellent color removal; however, upon regeneration and subsequent cycles of use the capacity of the exchanger was reduced by 70 to 80%. Additional study indicated that the regenerate could be reused and that a flow rate of 3 gpm/cu ft provided similar color removal to that achieved at 1 gpm/cu ft.
W82-02532

ENERGY COSTS AND PORTLAND WATER SUPPLY SYSTEM,
Bureau of Water Works, Portland, OR.
W. M. Elliot, and R. P. Hawley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 365-374, October, 1981. 7 Fig, 2 Ref.

Descriptors: *Water management, *Energy, *Costs, *Water distribution, Pumps, Hydroelectric plants, Conduits, Electric power, Gravity flow, Water mains, *Portland, *Oregon, Operating policies, Water policy, Municipal water.

Rising energy costs, over 600% in the last 10 years, have led the city of Portland, Oregon, to adopt new policies for managing its water supply system. Major energy savings are provided by: (1) installing a 50 million gal buried reservoir on Powell Butte, including conduits for interconnecting the entire water system, (2) constructing a gravity conduit to supply eastern Washington County, (3) retrofitting two existing dams to produce a total of 36 megawatts, (4) pump replacement and modification, and (5) improving pump operation. It is expected that energy costs will be reduced by 50% when all phases of the project have been completed. (Cassar-FRC)
W82-02586

TRIHALOMETHANE PRECURSOR CONTROL BY ADSORPTION,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
G. D. Reed, and A. F. Zey.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1095-1099, October, 1981. 5 Fig, 10 Ref.

Descriptors: *Adsorption, *Activated carbon, *Chlorinated hydrocarbons, *Water treatment, Ion exchange resins, Anion exchange, Organic compounds, Trihalomethanes, Organic matter.

Activated carbon (granular bituminous based Nuchar WVG) was effective in removing trihalomethanes and their precursors from prechlorinated, treated Missouri River water in pilot plant studies over the period September 1 to October 25. A weak base anion exchange resin (Diamond Shamrock ES-561), designed to adsorb high molecular weight organics, removed only small amounts of precursors, and the effluent concentration rose significantly with increasing run time. A carbonaceous resin (Ambersorb XE-340), designed to adsorb low molecular weight organics, had no capacity for removing trihalomethane precursors; effluent concentrations were often higher than influent concentrations. (Cassar-FRC)
W82-02598

5G. Water Quality Control

FEDERAL AND STATE COASTAL ZONE MANAGEMENT EFFORTS DIRECTED AT ESTUARIES AND FRESHWATER INFLOW,
National Oceanographic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W82-02113

STRATEGIES FOR THE MANAGEMENT OF ESTUARIES,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6F.
W82-02166

METHODS OF COMPUTATION AND ECOLOGICAL REGULATION OF THE SALINITY REGIME IN ESTUARIES AND SHALLOW SEAS IN CONNECTION WITH WATER REGULATION FOR HUMAN REQUIREMENTS,
M. Rozengurt, and I. Haydock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche.

In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 474-506. 10 Fig, 7 Tab, 37 Ref.

Descriptors: *Estuaries, *River flow, *Saline water intrusion, *Environmental effects, *Environmental protection, *Diversion losses, Pollution load, Fisheries, Dams, Canals, Water demand, Aquatic life.

Estuaries around the world are experiencing reduced freshwater inflows because of human actions such as damming and consumptive withdrawals, and natural causes. The low flow results in increased salinity in the estuary and salt water intrusion into previously freshwater stretches of the river. Research has shown that if freshwater flows are decreased by 25-30%, severe environmental disturbances result. Studies of some Russian rivers show that up to 50% of their flow is being diverted, and similar figures are available for flows into the San Francisco Bay-Delta. The freshwater flow reductions are aggravated by increasing pollution loads which reduce sustaining biota and hence reduce fish and shellfish populations. Two projects are being developed in Russia to prevent salinity intrusions into the rivers of the Black Sea and Azov Sea. A fixed sea water check dam will completely prevent the entrance of sea water into the delta and change the delta into a freshwater lake. A dam with a built-in restraining canal will ensure a constant connection with the sea but limit the entrance of sea water to acceptable levels. The former is preferable from the point of freshwater supply and the latter assures a better preservation of natural conditions and unimpeded navigation. Such a system is proposed for the San Francisco Bay-Delta, in the Carquinez Strait between Suisun and San Pablo Bays. (Brambley-SRC)
W82-02169

THE DILUTION/FLUSHING TECHNIQUE IN LAKE RESTORATION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W82-02270

HYPOLIMNETIC AERATION OF A SMALL EUTROPHIC KETTLE LAKE: PHYSICAL AND CHEMICAL CHANGES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
C. T. Taggart, and D. J. McQueen.
Archiv fur Hydrobiologie, Vol 91, No 2, p 150-180, May, 1981. 15 Fig, 5 Tab, 51 Ref.

Descriptors: *Lake restoration, *Aeration, *Water quality management, Dissolved oxygen, Oxygen, Hypolimnion, Metalimnion, Stratification, Eutrophic lakes, Tory Lake, *Ontario, Nitrogen, Phosphorus, Hydrogen sulfide, Manganese.

A small hypolimnetic aerator effectively removed Mn, P, and H2S from a small hypereutrophic lake, Tory Lake, Ontario, but was ineffective for nitrogen and CO2 removal. Aeration studies were conducted on two successive summers. The average dissolved oxygen concentrations in the hypolimnion were raised by 2.42 mg per liter in 1978 and by 1.47 mg per liter in 1979 from values < 1 mg per liter. The aerator was not capable of raising hypolimnetic dissolved oxygen above 5 mg per liter during the summer. Hypolimnetic cycling time was 4.15 days in 1978 and 3.07 days in 1979. Air flow rates in 1979 were increased to compensate for the increased hypolimnion volume, which was 2.5 times that of 1978. Stratification was not disturbed by the treatment. The metalimnion had increased H2S and was virtually anoxic by July in both summers. This condition would be a barrier to zooplankton and fish movements. (Cassar-FRC)
W82-02341

DENMARK'S STATE OF THE ENVIRONMENT,
For primary bibliographic entry see Field 5B.
W82-02401

SEWAGE OUTFALL LOCATION REDUCES ENVIRONMENTAL DAMAGE IN THE THAMES ESTUARY,
Metropolitan Pollution Control-Thames Water, London (England).
M. J. Andrews.
Water Science and Technology, Vol 13, No 7, p 265-270, 1981. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Estuaries, *Water pollution prevention, *Outfall sewers, Water quality control, Water quality management, Salinity, Wastewater outfall, Environmental effects, Ecological effects, Aquatic life, *Thames estuary, England.

The placement of major sewage outfalls in estuaries may be an important factor in minimizing environmental pollution. The least damage will occur where there are fewer species at risk. In estuaries, the junctions of mesohaline and oligohaline waters contain the smallest numbers of species. This area is unattractive to fishermen and is rarely used for swimming, since the average salinity is about five parts per thousand. In the Thames estuary, the minimal environmental damage would probably occur in areas where shellfish beds would not be destroyed, fish spawning affected, or bathing beaches made unfit for public recreation. The siting of London's major sewage outfalls at the five parts per thousands area of salinity has helped in accelerating the rehabilitation of the once polluted estuary by plants and animals. The principal disadvantage of locating outfalls at the five parts per thousand area is that both freshwater and marine components of the fauna are at risk. (Geiger-FRC)
W82-02404

THE DESIGN OF SEA OUTFALLS WITH REFERENCE TO EEC AMENITY WATER POLLUTION CRITERIA,
Dundee Univ. (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W82-02449

AN ESTIMATION OF THE REAERATION COEFFICIENT IN NATURAL STREAMS BY SPECTRAL ANALYSIS OF TIME SERIES DATA,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
T. Matsuo, and N. Yotsukura.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $6.75, Microfiche $3.50. Geological Survey Open-File Report 81-648, 1981. 47 p, 18 Fig, 4 Tab, 21 Ref.

Descriptors: *Model studies, Estimating, *Natural streams, *Spectral analysis, *Time series analysis, Mathematical models, Aeration, Dissolved oxygen, Biochemical oxygen demand, Light intensity, Water temperature, Streamflow, Flow characteristics, Reaeration coefficient, Mass transfer, *Water quality control.

Spectral analysis of time series data for the dissolved oxygen concentration (DO), water temperature, and sunlight intensity is used to estimate the reaeration coefficient of a natural stream. The streamflow is assumed to be steady and uniform hydraulically and homogeneous biologically. Under such conditions, the temporal variation of DO may be caused solely by that of the sunlight intensity. The DO mass balance equation becomes a first-order linear differential equation, which can be solved by means of the Fourier series. The reaeration coefficient is then expressed as a function of the phase shift between the sunlight intensity and DO, and between the sunlight intensity and saturation concentration of DO, and of the Fourier coefficients for the fluctuating portion of the DO and the saturation concentration of DO. Computing these parameters from data obtained at a single measurement station, the reaeration coefficient of the Cuyahoga River, Ohio, was estimated to range from 2.6 to 7.7 per day during selected periods in 1976 and 1977. (USGS)
W82-02458

EFFECT OF DRAINAGE SYSTEM DESIGN AND OPERATION ON NITRATE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W82-02505

COMPARISON OF METALS AS CATALYSTS FOR THE PHOTOLYSIS OF WATER,
Auburn Univ., AL. Dept. of Chemistry.
T. R. Webb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157801, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, November 30, 1980. 8 p, 11 Ref. OWRT-A-080-ALA(1), 14-34-0001-1101.

Descriptors: *Hydrogenation, *Photolysis, *Catalysts, *Metals, Rhodium, Platinum, Comparison studies, Chemical reactions, Water quality control.

A study of the platinum-catalyzed photolysis of water to produce hydrogen is described. Experiments indicated that rhodium could be substituted for platinum as catalyst, that palladium was feebly effective, and that ruthenium, gold, iridium, and silver were not effective. Studies of related ruthenium and iron complexes showed that ruthenium-phenanthroline and iron-phenanthroline complexes could work as light-absorbing species in place of a more-studied ruthenium-bipyridine complex; europium ion showed some promise as an electron-transfer reagent. Preliminary experiments suggest that hydrogenation of double bonds occurs in the system.
W82-02527

WATER LAW, WATER CONSERVATION AND THE DEVELOPMENT OF ENERGY RESOURCES IN THE COASTAL, OFFSHORE AND FLOOD PLAIN AREAS OF ALABAMA,
Alabama Univ., University. School of Law.
H. Cohen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157884, Price codes: A05 in paper copy, A01 in microfiche. Natural Resources Center, University of Alabama, Research Report, 1981. 93 p. OWRT-B-080-ALA(1), 14-34-0001-1201.

Descriptors: *Water law, Environment, *Oil and gas production, Pollution, *Coastal zone management, Wetlands, Flood plains, *Environmental control, *Water quality control, *Alabama.

This Report is about mineral development and water conservation in the coastal areas. It is not a discussion of the general problems of land and water uses in the coastal zones. It does not deal with the problems of residential housing along the beach fronts or dredging and filling for subdivision or condominium development. The coastal environment has always been thought to be hardy one, able to withstand a great deal of burdensome human activity, but it has recently been realized than man's various coastal projects bring significant environmental or ecological problems. The wetlands and the estuarine areas, including so called swamplands once considered wastelands, are now known to be vital to the balance of nature and essential to the plant and fish life as well as water quality in the area. The coastlines and wetlands are also flood plains. When great storms rage, as they inevitably do, the tides overcome the coastal areas. The Congress and numerous states have reacted to these dilemmas. Flood plain controls were created to prohibit construction which may damage property and endanger lives downstream. Wetland and coastal management legislation has been aimed at trying to preserve delicate ecological systems which affect the future of wildlife and the entire chain of natural phenomenon in the area. Out short term interests demand that we intensify our exploration for, and our production of oil and gas. Long term interests demand that we keep intrusion into our coastal areas and possible resultant pollution at a minimum. Out challenge is to conduct our mineral development in such a manner as to keep the environment as clean as possible.
W82-02535

THE PHYSICO-CHEMICAL AND PLANKTONIC RESPONSE OF AN ALGICIDE-TREATED SHALLOW MOUNTAIN LAKE IN ARIZONA,
Northern Arizona Univ., Flagstaff. Dept. of Biological Sciences.
S. S. Schwartz, D. W. Blinn, and G. Johnson.
Internationale Revue der Gesamten Hydrobiologie, Vol 66, No 2, p 249-262, 1981. 2 Fig, 1 Tab, 37 Ref.

Descriptors: *Algicides, *Plankton, Lakes, *Arizona, Mountain lakes, Eutrophication, *Water quality control, Physicochemical properties, Algae, *Ashurst Lake, Ecosystems, Ecological effects.

The response and recovery of a mountain lake ecosystem was followed after treatment with an algicide. The physico-chemical parameters and phytoplankton and zooplankton populations were monitored during the course of the study in Ashurst Lake. Frequent winds, shallow depth and the exposed nature of the basin insure that the lake's water column remains nearly homogeneous throughout the year. The lake was treated with Aquazine (simazine) on 9 July 1975 at an active concentration of 0.45 mg/liter to analyze its effectiveness for controlling nuisance blue-green algal blooms. Sampling was initiated on 25 May 1975 and continued at biweekly intervals until 9 November, with the remainder of the sampling done at monthly intervals for a total of 2.5 years. Within 3 days of treatment a minor bloom of Anabaena circinalis was reduced by 30%, and after 14 days to negligible cell numbers. This species failed to be a major component of the phytoplankton for the next 2.5 years. The usual late summer bloom species, A. flos-aquae, appeared at reduced densities about 1 month after treatment. In the summer of 1976, A. flos-aquae appeared during about the same period as recorded for years prior to treatment. Algicide concentrations of more than 3.0 mg/liter were adequate to control blue-green bloom species. The following September the lake was treated with rotenone to remove trash fish. Surface blooms of A. flos-aquae disappeared within 12 hr of treatment. Cryptophyta appeared to benefit during this time. (Baker-FRC)
W82-02571

LIMING ACID PONDS IN NEW YORK,
New York State Dept. of Environment Conservation, Watertown.
L. M. Blake.
New York Fish and Game Journal, Vol 28, No 2, p 208-214, 1981. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Lime, *Acidic water, Water, Acid rain, Fishing, *New York, *Lakes, Ponds, Water quality, Hydrogen ion concentration, *Fish populations.

This paper reviews various treatments, considering changes in pH, alkalinity and fish populations as a result of liming ponds to neutralize acid conditions. Cost-benefit ratios are considered. Application of hydrated lime in New York State is limited to open-water periods for economic reasons. Hydrated lime is superior to the less potent agricultural lime, calcium carbonate, although the latter permits a longer time between treatments. No matter which type of lime is used, the lime is dumped from bags from a slowly moving boat. More lime is spread in shallow water areas than over deep water areas so that the lime is placed where the fish live and it is exposed more effectively to wave action and currents. The use of lime in remote areas is more difficult due to the high cost of transport. Possible increases in mercury content of fish after lime treatment were studied. Mercury levels were determined in brook trout from selected lakes, limed and unlimed. No increase in mercury levels was apparent in either limed or unlimed control waters. Costs for liming remote ponds range as high as $297 per acre. Experience with the dry dispersal method has shown that lime can be moved at a rate of 5 tons per hour. The average cost of this method should be about $100 per acre. It was concluded that for both accessible and remote ponds, liming is an effective and economically feasible tool which can be used to counteract the adverse impact of acid precipitation and maintain selected fisheries. (Baker-FRC)
W82-02572

WETLANDS USE FOR WATER MANAGEMENT IN FLORIDA,
Corvallis Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 4A.
W82-02590

GUIDELINES FOR CONTROL OF SEPTIC TANK SYSTEMS,
California Regional Water Quality Control Board, Oakland.
For primary bibliographic entry see Field 5B.
W82-02599

AUTOMATED STREAM DIVERSION FOR RESERVOIR PROTECTION,
Fraser (J. Kenneth) and Associates, Rensselaer, NY.
J. A. Besha, V. C. McGuffey, M. R. Rafferty, and M. P. Brown.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1085-1089, October, 1981. 1 Fig, 1 Tab, 2 Ref.

Descriptors: *Diversion structures, *Automation, *Storm water, Water quality control, Diversion, Reservoirs, Streams, Highway effects, Construction, Soil erosion, Erosion, Monitoring, Control systems, Turbidity, *Reservoir protection.

Control of water quality during highway construction in the Richmondville, New York, watershed was accomplished with an automated monitoring and stream diversion system. Turbidity, pH, and conductivity of the two influent streams are continuously monitored by electric probes. When these parameters exceed 20 NTU, pH 8.5, or 350 micromho 15 times during a 10 min period, the stream diversion sequence is activated. A programmable controller initiates opening of valves which release nitrogen gas into inflatable bladder dams at the points where streams enter the reservoir. Thus the flood is rerouted to the streams below the reservoir. The controller also controls sampling pumps, backwashing of sensing lines, data input and output, and a telephone communication system. Programmability allows fine adjustments for such perturbations as animals walking in the stream. In the first two years of operation 52 water diversion sequences were initiated by high turbidity, and four each by pH and conductivity excesses. Installation costs were $125,000, and annual operating costs, $20,000. (Cassar-FRC)
W82-02600

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE MOUTH OF THE COLORADO RIVER PROJECT; AN ECONOMIC DEVELOPMENT ENVIRONMENTAL ENHANCEMENT PROJECT,
Army Engineer District, Galveston, TX. Engineering Div.
For primary bibliographic entry see Field 4A.
W82-02148

COLORADO RIVER SIMULATION SYSTEM; AN EXECUTIVE SUMMARY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. S. Cowan, R. W. Cheney, and J. C. Addiego.
October, 1981. 16 p, 5 Fig, 1 Tab.

Descriptors: *Computer models, *Simulation, *Water management, *Colorado River, Water resources development, Water supply, Water demand, Hydrology, River flow, Water quality.

The CRSS (Colorado River Simulation System) is a deterministic digital computerized simulation model that has been developed by the Bureau of Reclamation in accordance with all the 'Laws of the River'. With CRSS, proposed changes to the operation or alternative development schemes of the river system can be modeled and their effect on the future quantity and quality of water in the river may be evaluated. The CRSS comprises seven programs and data bases: CRSM (Colorado River Simulation Model); operational control data; demand data base; demand input generation program (SMDID); natural flow and salt data base; hydrology input data generation program (MHYDRO); and output summary program (TAPEDIT). The basin as presently modeled consists of 24 reaches, each of which represents a specific geographic area, and within which up to 10 inflows and 10 different demands can be identified. The model simulates river basin flows on a monthly time frame, starting at the top of the basin and proceeding to the bottom. River flows are calculated at each inflow, demand, and reservoir sequence point. With the demand data base as input, SMDID generates the demand data for CRSM, and summaries of projected depletion by water use, state, and basin. The hydrology data input to CRSM is generated by running the program MHYDRO with the hydrology data base and control data as input. (Brambley-SRC)
W82-02170

SOLID SET IRRIGATION SYSTEM DESIGN USING LINEAR PROGRAMMING,
Ben-Gurion Univ. of the Negev, Sde-Boker (Israel). Inst. for Desert Research.
G. Oron, and D. Karmeli.
Water Resources Bulletin, Vol 17, No 4, p 565-570, August, 1981. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Linear programming, *Sprinkler irrigation, *Design criteria, Systems analysis, Costs, Pipes, Optimization, *Irrigation design, Case studies.

The formulation of a solid set irrigation system (sprinkler or trickle) using linear programming is presented. The formulation is based on an objective function for the minimum system cost and the various hydraulic and operational constraints. Given the characteristics of the water resource, the linear programming analysis will minimize the cost of a solid set system and obtain optimum pipe diameters and related sections lengths. The objective function consists of equipment, energy and labor components. The pipe network is optimized with the aim of determining optimal diameters for various pipe sections. A capital recovery factor assumes similar interest rates and longevity of all components. A case study is presented which develops a solid set under tree sprinkler system for an orchard (176 m x 144 m). (Small-FRC)
W82-02273

WEEKLY MULTIPURPOSE PLANNING MODEL FOR TVA RESERVOIR SYSTEM,
Tennessee Valley Authority, Norris.
J. E. Giles, and W. O. Wunderlich.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 495-511, October, 1981. 8 Fig, 7 Ref.

Descriptors: *Computer models, *Reservoir operation, *Dynamic programming, Mode studies, Decision making, Future planning, Planning, Economic aspects, Evaluation, Systems analyses, Fortran, Tennessee Valley Authority.

A weekly planning model for planning and operational studies of the Tennessee Valley Authority (TVA) reservoir system is described. The model simulates the operation of a multipurpose, multireservoir system by weekly time procedures up to one year and evaluates an objective function comprised of five cost functions. The model, which uses dynamic programming by successive approximations, was applied to various planning problems with influential system-wide impacts. Results showed the model to be a powerful computerized planning tool with an updatable system as applica-

tion experience increases. The effect of foresight has been evaluated in applications of the model to several case studies. Foresight may be limited by reducing the planning period, using constraints within the planning period, using overlapping planning periods and discounting future costs. The capabilities and limitations of the model have not yet been fully explored. Although the rigid constraint approach was found to be the most expedient technique for the decision makers of the TVA organization, the model is not limited to this approach and may be used when policies are based on direct measures. (Geiger-FRC)
W82-02319

POSSIBILITY OF INVESTIGATING OPEN-CHANNEL FLOWS ON AN ANALOG COMPUTER,
K. N. Koida.
Hydrotechnical Construction, No 3, p 268-269, March, 1980. 3 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 34-35, March, 1980.

Descriptors: Open channels, *Computers, *Analog computers, Flow measurement, *Flow characteristics, Flow discharge, Flood discharge, Stream discharge, *Model studies, *Open-channel flow.

The differential equation of a uniform gradually varied flow with a constant discharge in an open cyclindrical channel is considered. This equation is usually solved numerically on a digital computer in plotting the curves of the free surface. Analog computers have not generally been used for this type of problem. However, through some manipulations, this matter can be handled on the analog computer as well, which deals quite adequately with a system of nonlinear equations. Use of the analog computer permits the investigator to change the initial depth and bottom slope during modeling, to determine the critical and normal depths and critical slope, and to investigate any type of curves of the free surface. Investigations of flows in open channels on an analog computer are distinguished by clarity. A cathode-ray tube display is used to observe the solution. The accuracy of the solution depends on the type of computer used. With modeling on the MN-7M it was possible to find the normal depth, determined preliminarily on a digital computer with a high accuracy, with an error of 7%. Flows in channels with a variable slope of the bottom can also be investigated on the analog computer. (Baker-FRC)
W82-02389

EMPHASIS ON DISTRIBUTION: STRATEGIES FOR SMALL SCALE WATER RESOURCES DEVELOPMENT IN THAILAND,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
A. Arbhabhirama, S. Angel, and M. R. Brewster.
Water Resources Bulletin, Vol 17, No 3, p 483-493, June, 1981. 2 Fig, 4 Tab, 15 Ref.

Descriptors: *Water distribution, *Water resources development, *Water policy, *Thailand, Reservoirs, Irrigation systems, Planning, Short-term planning, Canals, Rivers, Water supply development, Economic aspects, Developing countries, Subsidies.

Water resources development for northeast Thailand, the poorest region in the country, should shift its emphasis from construction of large storage reservoirs which benefit a few farms to construction of water distribution systems which reach a large number of farms. The water policy for this area should entail: effective distribution of water from existing large reservoirs and reliable rivers to people adjacent to these sources, and development of small water resource projects (small reservoirs, weirs, ponds, and wells) to meet the needs of farms out of reach of the large reservoirs and rivers. Three zones were defined, based on access to water supply sources. A 5-year plan (1980-85) for implementing these strategies has been formulated. There are six key recommendations: (1) move rapidly to adopt a water resources development strategy for this area by establishing the appropriate agencies, (2) support and improve existing distribution systems, (3) increase provincial involvement in the small water projects, (4) initiate a provincial water survey to identify the best water projects for each village, (5) allocate subsidies for village water projects based on a fixed subsidy per family, average $250 per family or $500 million total, and (6) encourage villagers to own and operate their own water projects. (Cassar-FRC)
W82-02408

THE USE OF MATHEMATICAL MODELLING AS A DECISION-MAKING TOOL IN THE WATER AUTHORITIES OF ENGLAND AND WALES FOR WATER-QUALITY MANAGEMENT,
Newcastle upon Tyne Univ. (England).
K. D. Russell, and M. B. Pescod.
Water Pollution Control, Vol 80, No 3, p 390-397, 1981. 4 Tab, 9 Ref.

Descriptors: *Water quality management, *Mathematical models, Model studies, Planning, Decision making, Administrative decisions, *Great Britain.

This paper reviews experience gained in England using mathematical modelling techniques as decision making tools in water quality management. Information was collected through questionnaires sent to all water authorities of England and Wales in December 1978. It appeared that 27 models are available for use in the ten water authorities. Most authorities have two models. Roughly half of the available models are for the freshwater regime, and the other half are for tidal applications. The most popular model language in use was Fortran. Due to the high cost of model production, many authorities have adopted the Water Research Center inland water quality model for use in freshwater regimes. Running costs and CPU times were variable, depending on computer installation, computer operating system, complexity of the system modelled and optimality of the solution. The most common application for modelling was in setting consent conditions for discharges. Other important uses included dealing with alterations in flows due to regulation or abstraction. Five models were used in planning new treatment works. Two models have direct economic connotations. In general it appeared that insufficient data are used, which will necessarily result in unrealistic predictions when the models are applied where conditions are outside those of the calibration range. It was felt that techniques used to generate water quality data need to be evolved to assist in overcoming the resource restrictions of real data collection. Synthetic flow generation has been used for some time in the field of hydrology, and this approach would be of use if applied to water quality. (Baker-FRC)
W82-02424

SYSTEMS ANALYSIS APPLIED TO WATER MANAGEMENT IN DEVELOPING COUNTRIES: PROBLEMS AND PROSPECTS,
Biswas and Associates, Oxford (England).
A. K. Biswas.
Environmental Conservation, Vol 8, No 2, p 107-112, Summer, 1981. 7 Ref.

Descriptors: *Developing countries, *Systems analysis, *Water management, Regional development, Computers, Model studies.

Third world countries have not generally made use of systems analysis and the application of computer technology for planning water resources development and management processes. Because water management is so complex, it is important to utilize any available tool such as systems analysis to analyze all possible strategies and viable alternatives. Models do not fail because of lack of technical expertise or inadequate computer technology. Failure is usually the result of managerial problems. Models can be used in developing countries, although some models of this type are rather crude and are dependent upon the judgment and expertise of the analyst. (Small-FRC)
W82-02441

WATERLOGGING CONTROL FOR IMPROVED WATER AND LAND USE EFFICIENCIES: A SYSTEMATIC ANALYSIS,
Colorado State Univ., Fort Collins. Water Resources Research Inst.
A. Simpson, H. J. Morel-Seytoux, R. A. Young, G. E. Radosevich, and W. T. Franklin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157983, Price codes: A08 in paper copy, A01 in microfiche. Completion Report No 108, December, 1980. 138 p, 41 Fig, 3 Tab, 46 Ref, Append. OWRT-C-7144(6211)(2), 14-34-0001-6211.

Descriptors: Pump drainage, Reclamation of waterlogged lands, Surface-groundwater simulation, Drainage of waterlogged lands, *Waterlogging, *Salinity, *Irrigation practices, *Groundwater management, *Land management, Drainage, Surface-groundwater relations, Model studies, *San Luis Valley, *Colorado, Rio Grande River.

The problems of waterlogging and salinization are often associated with irrigated agriculture. Both these problems exist in the San Luis Valley, in southern Colorado. This study considers a 500 square mile study area south of the Rio Grande River in the San Luis Valley. Many thousands of acres of the study area are subject to waterlogging each year. A Fortran IV computer simulation model of the stream-aquifer-irrigation system in the study areas was developed. The computer simulation model is used to investigate two alternative management strategies and to compare effects with past water management programs (the 'historic strategy'). These strategies aim to lower the water table in the waterlogged area to enable the growing of crops using center-pivot sprinkler irrigation. The report is divided into two main parts. The first part describes the study area and the components and interactions considered in the development of the hydrologic computer model, including a detailed description of the actual computer program. The second part of the report concerns an analysis of the management strategies aimed at reducing the waterlogging problem. The historic strategy and two alternative management strategies were subject to analysis. The first alternative management strategy involves a 16 square mile well field called the La Jara Creek well field development. The second alternative strategy is the 10 square mile Rock Creek well field development. A comparison of the effects of the historic management strategy and the two alternative well field development strategies is provided.
W82-02455

ANALYSIS OF FIRM WATER SUPPLY UNDER COMPLEX INSTITUTIONAL CONSTRAINTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. M. Shafer, J. W. Labadie, and E. B. Jones.
Water Resources Bulletin, Vol 17, No 3, p 373-380, June, 1981. 5 Fig, 2 Tab, 8 Ref. OWRT-B-201-COLO(3).

Descriptors: *Water rights, *Reservoir operation, *Institutional constraints, Water allocation, Water policy, Water supply, Water management, Water users, Water use efficiency, Water reuse, Cooling ponds, Legal aspects, Rawhide project, *Colorado, Powerplants, *Model studies, River basins, Diversion.

Legal and institutional factors (such as formal and informal water rights) governing water allocation were included in a river basin simulation study of the Cache la Poudre River basin, Colorado, site of the planned Rawhide coal fired steam electric generation facility. Objectives for this study were to determine if the cooling pond at the plant could be filled prior to the beginning of power generation in 1985 and if a minimum 4200 acre-feet of reusable water could be provided at a uniform rate after filling. The MODSIM model was calibrated by adjusting physical parameters until they reasonably fit historical operational priorities. These priorities included water quality, flood control, recreation, and hydropower. Alternatives for reservoir operation and diversions were evaluated, dividing the water system into links and nodes representing reservoirs, ponds, municipal use, wastewater treat-

ment plants, rivers, canals, and effluents. This determined the optimum scheme for filling and maintaining the cooling pond without causing harm to present water users in the basin. A prior agreement had decreed an 8038 acre feet per year reservoir release; the model reached a figure of 8122 acre feet. (Cassar-FRC)
W82-02501

DELINEATION OF ACID MINE DRAINAGE POTENTIAL OF COAL-BEARING STRATA OF THE POTTSVILLE AND ALLEGHENY GROUPS IN WESTERN PENNSYLVANIA,
The Pennsylvania State Univ., University Park. Dept. of Geosciences.
R. J. Hornberger, R. R. Parizek, and E. G. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157876, Price codes: A17 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, The Pennsylvania State University, Research Project Technical Completion Report, November, 1981. 359 p, 159 Fig, 18 Tab, 197 Ref. OWRT-B-097-PA(1), 14-34-0001-7182.

Descriptors: *Acid mine drainage, Mine drainage, Stratigraphy, Hydrogeology, *Path of pollutants, Forecasting, *Model studies, *Coal mining, *Pennsylvania, *Paleoenvironment, Water quality, Groundwater quality.

The goal of the research was to test the relationship between paleoenvironment and acid mine drainage production on a regional basis. Coal mining data from 23 counties, or approximately 225 quadrangles, were obtained from mine drainage permit records, and a computer program was written to map these data. More than 150,000 lines of water-quality data were retrieved from the STORET data base, from which contour maps and trend surface maps were constructed. A computer program was developed to compare the water-quality and coal mining data using a grid cell structure. Five subregions of differing geologic setting were delineated within the study area, and variations in acid production of specific stratigraphic intervals across the subregions were examined using deep-mine drainage data, ground-water data and data obtained from leaching experiments, sulfur analyses, and microscopy of coal samples. There appeared to be significant relationship between the presence of calcareous strata and the lack of acid mine drainage from associated underlying coals. However in non-calcareous facies, no significant relationship between variations in paleoenvironment and variations in acid production could be determined from regional water quality patterns, or deep mine drainage data, or laboratory leaching tests.
W82-02534

DEVELOPMENT OF A PROTOTYPE METHOD FOR TRAINING USERS OF WATER RESOURCES PLANNING MODELS: PHASE I,
Montana State Univ., Bozeman. Dept. of Industrial and Management Engineering.
D. W. Boyd, and T. G. Plaggemeyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157934, Price codes: A05 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 118, September, 1981. 102 p, 4 Ref, 2 Append. OWRT-A-124-MONT(1), 14-34-0001-0128.

Descriptors: *Computer models, *Education, River basin development, *Management planning, Interactive computing, *Montana Water Planning Model, Self-instruction method.

The once operational Montana water planning model has been lost to the Montana Department of Natural Resources and Conservation due to personnel turnover. Upon implementation in 1973, the model demonstrated its utility as a planning tool during the 1973-1976 moratorium on the Yellowstone River Basin. The cost in time and effort for new personnel to learn how to use the model by reading the original technical reports is prohibitive. Alternatively, learning could be accomplished at a much lesser cost if a computerized training method were available. Accordingly, a prototype method for training users of water resources planning models was developed. The program (called PLANNER) is accessed from a terminal connected to a mainframe computer. The program operates in the interactive mode and features a step-by-step development of a macro model of the Yellowstone River Basin. A companion user's manual is provided. From experience with the prototype to date, it is recommended that water planning agencies adopt a computerized training program for its water planning personnel. In addition, the program should be installed on a minicomputer dedicated to water planning rather than on a mainframe computer system which is subject to constant change. (Hunt-Mont)
W82-02540

OPTIMAL STREAM-AQUIFER DEVELOPMENT,
Illinois Univ. at Urbana-Champaign. Dept. of General Engineering.
O. Coskunoglu, and C. M. Shetty.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 513-531, October, 1981. 4 Fig, 2 Tab, 40 Ref.

Descriptors: *Computer models, *Water management, *Water resources development, *Design criteria, Model studies, Aquifer management, Groundwater management, Water supply development, Groundwater recharge, Water use, Mathematical models.

A large, nonlinear, nonconvex mathematical model was formulated to optimize the conjunctive use of surface and groundwater resources for irrigation, hydropower generation, aquifer recharge and other mandatory requirements. The designing of solution procedures offered a more realistic approach to engineering problems. The solution procedure, programmed in FORTRAN, was tested with realistic data to obtain an optimal solution for a problem with 394 variables and 390 constraints. The total execution time required to compute the optimal design and operation would cost about $200. With experienced practitioners, better starting points for computation may be achieved, making the convergence to the optimal solution more rapid. Calculations of optimal operations revealed that in wet periods, the surface water usage rate increases, while the groundwater usage rate decreases. The opposite occurs in dry periods. The reservoir detention requirements would decrease as a result of this synergism, while the overall net benefits increase. The refinement achieved in solving dynamic programming problems is also discussed. (Geiger-FRC)
W82-02575

OPERATION POLICY ANALYSIS: SAM RAYBURN RESERVOIR,
Hydrologic Engineering Center, Davis, CA.
D. T. Ford, R. Garland, and C. Sullivan.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 339-350, October, 1981. 4 Fig, 4 Tab, 16 Ref.

Descriptors: *Operating policies, *Reservoir operation, Systems analysis, Model studies, Simulation analysis, *Sam Rayburn Reservoir, *Texas, Saline water intrusion, Multipurpose reservoirs, Optimization, Water allocation, Water storage, Water use, Reservoir storage.

A combined optimization-simulation method was developed and used to solve management problems at the two-reservoir Sam Rayburn system, Texas. The major concerns at this installation are salt water intrusion, hydropower production, recreational use, and flood control. The simulation model is a single reservoir model that accounts for water use throughout the system, satisfying demands and allocating water according to specific priorities. The simulation model is linked with a nonlinear programming algorithm that selects the optimal operating policy. The resulting operating policy is smoothed using the engineering judgment of persons involved in daily operation of the system, and system response with this smoothed policy is simulated. Reiteration of this step is performed to obtain the final operating policy. (Cassar-FRC)
W82-02589

COMPARISON OF DETENTION BASIN PLANNING AND DESIGN MODELS,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. R. Donahue, R. H. McCuen, and T. R. Bondelid.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 385-400, October, 1981. 3 Fig, 6 Tab, 12 Ref.

Descriptors: *Storm water, *Urban drainage, *Detention reservoirs, Model studies, Design criteria, Planning, Runoff, Rainfall-runoff relationships, Drainage, Storage capacity, Water management, Flood control, Comparison studies, Land use.

Significant differences in storage volume were obtained using seven different methods of designing storm water detention basins. It is suggested that planners select a method most representative of the local hydrology. Comparisons of two design methods and five planning methods on watersheds of 50, 200, and 500 acres; for residential, commercial, and industrial land uses; and for 10 and 100 year return periods indicated that two of the models were most suitable. The Bondelid method, a computerized optimization method, was recommended for design purposes. The Soil Conservation Service TR-55 method, using input similar to the Bondelid method, was recommended for planning purposes. Other methods considered were: Baker, Illinois Urban Drainage Area Simulator (ILLUDAS), Abt and Grigg, Wycoff and Singh, and Loss of Natural Storage. (Cassar-FRC)
W82-02592

6B. Evaluation Process

INSTITUTIONAL BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN THE SOUTHEAST - VOL II - TECHNICAL REPORT, PART II - ISSUES, PROBLEMS, AND DATA,
Tennessee Univ., Knoxville. Graduate School of Planning.
For primary bibliographic entry see Field 6E.
W82-02102

SEDIMENT--ASSET OR LIABILITY,
Coastal Environments, Inc., Baton Rouge, LA.
J. L. van Beek, and K. Meyer-Arendt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 197-215. 9 Fig, 15 Ref.

Descriptors: *Sediments, *Sedimentation, *Estuaries, *Navigation, *Flow separation, Estuarine environment, Aquatic habitats, Wetlands, Cost-benefit analysis, Dredging, Wildlife, Fish, Colorado River, Atchafalaya River, Comparison studies.

Sediment introduction is a corollary of river-associated freshwater inflow in many estuaries. These sediments represent an asset relative to delta building and associated estuarine wetlands, a liability in maintaining navigation access. A multipurpose approach to resolving this conflict is the separation of navigation from sediment-laden freshwater inflow. Such a separation, as authorized for the Colorado River, provides dual benefits: reduced maintenance dredging and increased fish and wildlife resources. In contrast, failure to do so at the Lower Atchafalaya River, Louisiana, increasingly results in dual cost. Comparison of the two projects raises serious questions about the consistency of project evaluation and cost/benefit analysis.
W82-02150

LOSS OF COLORADO RIVER INFLOWS TO MATAGORDA BAY, TEXAS, AND EFFORTS FOR RESTORATION,
For primary bibliographic entry see Field 4A.
W82-02151

MANAGEMENT, PLANNING, AND ORGANIZATION IN INITIATING, SUPPORTING AND COORDINATING AN ONGOING FRESHWATER DIVERSION PROJECT,
University of Southern Mississippi, Hattiesburg.
D. J. Etzold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 248-254. 3 Ref.

Descriptors: *Estuarine fisheries, *Diversion, *Planning, *Management, Public participation, Evaluation, *Cost benefit analysis, Marshes, Erosion, Seafood productivity, Louisiana, Mississippi.

Seafood productivity declines in Louisiana and Mississippi have resulted from the lack of freshwater inputs on a controlled basis into the marine estuaries. This decline prompted people in the industry to seek help in developing a project to obtain the needed freshwater inflows. A task force was established in 1973 for preliminary planning purposes, which recognized the need for evaluation of the technical, environmental, economic, financial, social, and political and legal factors involved. The task force worked with many agencies involved with water resources and obtained the support of 12 organizations and agencies representing a broad base of public support. The plans submitted to Congress were approved and referred to the Corps of Engineers for studies to be conducted. The studies are now in progress, being combined with two other freshwater studies. An initial report indicates that the monetary benefits to fish and wildlife range from $4.4-5.2 million, and that the freshwater input will substantially reduce the serious loss of Louisiana marshes. The work of the task force is to monitor progress and continue support of the project, which has been in progress for 7 years and will need a further 8-10 years before freshwater flows are obtained. (Brambley-SRC)
W82-02153

FRESHWATER INFLOW TO THE COLUMBIA RIVER ESTUARY; A NORTHWEST REGIONAL MANAGEMENT ISSUE,
Pacific Northwest River Basins Commission, Vancouver, WA.
For primary bibliographic entry see Field 6D.
W82-02155

ECONOMIC IMPACT OF EXISTING AMMONIA NITROGEN WATER QUALITY STANDARD, IPCB CHAPTER 3, RULE 203 (F),
Southern Illinois Univ. at Carbondale. Dept. of Thermal and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W82-02189

THE ECONOMIC SIGNIFICANCE OF THE LONG POINT MARSH, LAKE ERIE, AS A RECREATIONAL RESOURCE,
Guelph Univ. (Ontario). Dept. of Geography.
R. Kreutzwiser.
Journal of Great Lakes Research, Vol 7, No 2, p 105-110, 1981. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Wetlands, *Economic aspects, Marshes, *Long Point Marsh, *Ontario, Canada, Wilderness areas, Wildlife, Hunting, Recreation demand, *Lake Erie.

A study was made of the recreational significance of public marshes at Long Point and Point Pelee on the north shore of Lake Erie. Emphasis was placed on estimating the economic value of the Long Point marsh as a recreational resource. The marshes under consideration occupy about 12% of the estimated 12,200 hectares of public and private marsh land on the north shore of Lake Erie. In 1978 the Long Point marsh provided opportunities for nature viewing, photography, fishing, waterfowl hunting, and canoeing for about 17,000 users. About 70% of the respondents to a questionnaire indicated that a wetland recreational activity was their primary purpose for visiting the Long Point area. In pursuing these activities, the users had a direct economic impact on the local communities through money spent there. Recreational users of the Long Point marsh spent in excess of $250,000 on gas, food, lodging and other items associated with their visit, of which about $120,000 was spent in the local area. This estimated $120,000 in local spending seems insignificant in terms of total sales in tourist-serving businesses in the area. However, tourist spending generates additional economic activity as tourist dollars work their way through the economy. In Ontario it is estimated that every dollar of tourist spending generates an additional 88 cents. On this basis, some $225,000 in local business income was generated directly and indirectly by recreational users of the Long Point marsh. (Baker-FRC)
W82-02229

WATER-RESOURCES INFORMATION FOR THE WITHLACOOCHEE RIVER REGION, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. A. Miller, W. Anderson, A. S. Navoy, J. L. Smoot, and R. G. Belles.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A106929, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-11, 1981. 130 p, 39 Fig, 20 Tab, 94 Ref.

Descriptors: *Surface water, *Groundwater, *Water use, *Streamflow, Aquifer characteristics, Lakes, Springs, Salinity, Wells, Water yield, Transmissivity, Water level fluctuations, Water quality, Data collections, *Florida, West-central Florida, *Withlacoochee River.

Daily water use in the Withlacoochee River region in 1977 averaged about 2,005 million gallons per day, 94 percent being saline surface water used in thermoelectric power-generation cooling. The largest user of freshwater was Hernando County, using 43.02 million gallons per day. The Floridan aquifer in the region consists mostly of limestones and dolomites, and is as much as 1,500 feet thick. Transmissivities are known to be as high as 25 million feet squared per day. Yields of 2,000 gallons per minutes from 12-inch wells are possible. Although the range in fluctuations of the potentiometric surface is as great as 20 feet, no significant change has occurred since the 1930's when data were first collected. The quality of water in the Floridan aquifer is generally excellent. Saltwater is present in the aquifer near the Gulf Coast and in extreme east Marion County, near the St. Johns River. The predominant chemical type for both streams and springs is calcium and magnesium bicarbonate due to the dissolution process of the carbonate rocks. The majority of the streams have average dissolved-solid concentrations between 100 and 200 milligrams per liter, maximum-observed specific conductance between 250 and 750 micromhos per centimeter, and average total nitrogen concentrations of less than 1.2 milligrams per liter. (USGS)
W82-02473

WASTEWATER COLLECTION AND TREATMENT IN WAYNE COUNTY,
Wayne County Board of Public Works, MI.
For primary bibliographic entry see Field 5D.
W82-02554

IN-HOME CONSERVATION AND WASTEWATER MANAGEMENT,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 3D.
W82-02591

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DESALTING DEMONSTRATION PLANT FEASIBILITY STUDY AT LAGUNA PUEBLO, NEW MEXICO.
MetaMetrics Inc., Washington, DC.
For primary bibliographic entry see Field 3A.
W82-02104

THE ECONOMIC SIGNIFICANCE OF THE LONG POINT MARSH, LAKE ERIE, AS A RECREATIONAL RESOURCE,
Guelph Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 6B.
W82-02229

TEXAS TO VOTE ON WATER TRUST FUND.
Southwest and Texas Water Works Journal, Vol 63, No 7, p 16, October, 1981.

Descriptors: *Financing, *Water policy, *Local governments, *Texas, Water law, Legal aspects, Loans, Water resources development.

The Texas legislature has proposed an amendment to the state constitution for establishing a water trust fund to guarantee repayment of local government water bonds and to increase the maximum interest rate on state bonds to 12%. This amendment would provide funds for badly needed water supply and flood control projects at a modest cost to the state government. Half of the excess state revenue would be placed in the water trust fund for dispersal in three forms: a loan fund, a storage and acquisition fund, and a research and planning fund. The proposal was scheduled for a vote on November 3, 1981. (Cassar-FRC)
W82-02302

COST OF SMALL WATER SUPPLY TREATMENT SYSTEMS,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5F.
W82-02318

EFFLUENT CHARGING SYSTEMS AND THEIR ADMINISTRATIVE IMPLICATIONS,
Environmental Resources Ltd., London (England).
R. Bidwell, and S. Mason.
Water Science and Technology, Vol 13, No 7, p 393-411, 1981. 3 Fig, 3 Tab.

Descriptors: *Effluent charges, *Administration, *Costs, *Water pollution control, Water quality control, Permits, Pollution taxes, Waste discharge, Wastewater discharge, Monitoring, Reviews, France, Germany, Netherlands, United Kingdom.

The present and proposed effluent charging systems in France, Germany, the Netherlands, and the United Kingdom are reviewed with attention to characteristics of effluent treatment charges and characteristics of pollution charges. Types of dischargers, methods used to levy charges, links with the permit system, and use of collected revenue are considered. A hypothetical region with 1 million population, 2000 large industrial dischargers, 8000 other non-domestic dischargers, and 25 treatment plants is used to evaluate the effects of several water pollution control programs on administrative costs. A table summarizes the administrative costs in $ million (U.S.) as follows: permit system only, 0.9-5.8; permit and charging with existing samples and analyses, 1.1-6.0; and permit and charging with additional samples and analyses, 1.2-9.8. Additional charges (in $ million U.S.) produced by the following modifications will be incurred with the above permit systems: separate effluent treatment charging and pollution charging systems, 0.07; inclusion of both large and small industrial users, 0.06; inclusion of domestic premises, 1.0: increasing the 50 water quality monitoring points to 200, 1.0. (Cassar-FRC)
W82-02403

RATE STRUCTURES AND DEMAND REDUCTION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
R. McGarry.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 52-58. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Water rates, *Drought, Long-term planning, *Water deficit, Water shortage, *Economic aspects, *Water conservation, Industrial water use, Water supply, Water use, River forecasting, Public policy, River flow, Maryland, Prince George's County, Montgomery County.

The Washington Suburban Sanitary Commission is a state water agency that serves two counties in Maryland. It began in 1970 with an emphasis on water conservation, which was unusual at that time. The public wanted conservation planning, and the Commission responded with a four-phase program: publicity and education, plumbing code changes, a rate structure that supports conservation, and the incorporation of drought and risk management in water-supply planning. A citizen's advisory group recommended that the rate structure increase with the amount used, with the result that some people on fixed incomes now have quarterly bills of only $6-8. Drought management planning involved a careful analysis of demand and a decision that the 100-gallon per person per day concept was wrong, and that usage should be based on hookups, not population. Water records were converted to probabilities, and a three-phase emergency action plan was developed for shortages. The system was planned so that drastic measures would be incurred less than 1 percent of the time. Results of conservation program are mixed: while residential conservation has been widely practiced, participation from the industrial sector has been disappointing. Drought management and conservation broke a planning stalemate that had been in existence for 18 years. Some problems have been encountered; e.g., a public misunderstanding that water bills would decrease, a difficulty for utilities in predicting revenue, and remaining uncertainty with reservoir-operating/river flow forecast management. (Garrison-Omniplan)
W82-02517

WATER SAVINGS IN THE ORANGE WATER AND SEWER AUTHORITY,
Orange Water and Sewer Authority, Carrboro, NC.
For primary bibliographic entry see Field 3D.
W82-02519

ANALYTICAL COST MODEL FOR URBAN WATER SUPPLY,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, and R. G. Stevie.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 437-452, October, 1981. 4 Fig, 6 Tab, 14 Ref.

Descriptors: *Water distribution, *Urban areas, *Economies of scale, *Water costs, *Water supply, Water consumption, Water treatment, Water transport, Regional planning, Planning, Population density, Cost analysis, Economic aspects, Drinking water, Municipal water, Utilities.

This paper emphasizes the tradeoffs that must be considered in developing regional water distribution systems. Economies of scale of the acquisition/treatment component may be offset by diseconomies in transportation/distribution. Using the cost functions for each component, equations are developed to show the relationship between the minimum cost point for a water distribution system and the distance from the point of production. Before this point the average cost with respect to distance decreases, and after this point, it increases. Per capita consumption and absolute levels of population density have little effect on least cost system size. However, the minimum cost solution is very sensitive to population distribution. In many cases the minimum cost point is approximately 8 miles. (Cassar-FRC)
W82-02584

ENERGY COSTS AND PORTLAND WATER SUPPLY SYSTEM,
Bureau of Water Works, Portland, OR.
For primary bibliographic entry see Field 5F.
W82-02586

6D. Water Demand

WATER MANAGEMENT ON THE COLUMBIA RIVER,
Columbia River Basin Commission, Portland, OR.
D. Kent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 79-83.

Descriptors: *Water management, *Competing use, *Estuaries, *Water supply, *Water demand, Fisheries, Irrigation water, Hydroelectric plants, Recreation, Navigation, Judrisdiction, Water policy, *Columbia River, Pacific Northwest.

The Columbia River, with its estuary and its tributaries, is the dominant Pacific Northwest water resources system. Discharges on an annual average are about a quarter of a million cubic feet per second of water at its mouth. The regions water problems stem largely from the competing uses to which the river is put. The river supplies hydroelectric power, supports ever-increasing agricultural production with irrigation development, provides transportation, maintains fishery resources, and provides recreational opportunities for everyone. Already, competition between hydroelectric generation and irrigation is intense. Meanwhile, hydropower and irrigation demands are putting pressure on a third use, the fish runs. For maintaining fish runs, water must be available in adequate quantity and quality at the proper times for both the upstream and downstream passage of the fish. Jurisdiction is another source of difficulty: the Columbia River system waters within the U. S. are controlled by seven states, at least nine Federal agencies, several state organizations, and multitude of public entities, local jurisdictions, and private individuals (under permit). The result is a variety of piecemeal and conflicting policies for the use of the Columbia River water. The uses which are economically most profitable are the ones which receive the greatest consideration by the decision-makers. In the case of the Columbia, hydropower is the most important, followed by irrigation, transportation, and fisheries and conservation. (Moore-SRC)
W82-02112

OVERVIEW OF FRESHWATER INFLOW DEPLETIONS,
Fish and Wildlife Service, Fort Collins, CO.
K. Bayha.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 231-247. 9 Fig, 2 Tab, 2 Ref.

Descriptors: *Water resources development, *Streamflow depletion, *Water demand, *Water supply, *Estuaries, Groundwater mining, Groundwater depletion, Environmental effects, Planning, River flow.

An analysis of the accumulated depletion of streamflow in the nation's major watersheds was attempted for the first time as part of the Second National Water Assessment conducted by the U.S. Water Resources Council. This paper utilizes that data base to demonstrate the relative reduction of freshwater inflow to estuaries due to upstream water resource development. Data for normal (average) and dry (80% exceedance) year conditions are presented for 106 assessment subregions, including 30 coastal estuarine complexes. The data show that greater water use in the year 2000 will result in reduced flows to the estuaries. An exception is the Texas coast where groundwater mining augments the surface water supply. In general groundwater mining will decrease, because of the lowering of the water table and increased pumping costs. The further depletion of flows to estuaries will produce additional environmental impacts. Data should be developed so that water resource planner could link estuarine needs for freshwater inflow with instream flow needs to permit meaningful evaluation of impacts of water projects proposed in the headwaters. (Brambley-SRC)
W82-02152

FRESHWATER INFLOW TO THE COLUMBIA RIVER ESTUARY; A NORTHWEST REGIONAL MANAGEMENT ISSUE,
Pacific Northwest River Basins Commission, Vancouver, WA.
D. H. Kent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 270-276. 1 Fig, 6 Ref.

Descriptors: *Columbia River, *Estuaries, *Water demand, *Water supply, *River flow, Data acquisition, Water resources development, Planning, *Cost-benefit analysis.

The Columbia River is the largest freshwater drainage system on the Pacific coast of North America, yet less is known about its estuary than about any other of comparable size in the United States. With many conflicting uses for its water (agriculture, power generation, navigation, and fisheries), the Columbia River system is unable to meet all the demands for water during periods of reduced discharge, when demand is greatest. The Pacific Northwest River Basins Commission, as the interagency regional planning organization dealing with water resource planning in the Columbia River system, has undertaken two programs designed to deal directly with this issue of instream flows. The Regional Tradeoffs Analysis Program will be evaluating and documenting competition among various water uses and the economic, environmental, and social benefits and costs (tradeoffs) which would result from alternative levels of use for competing purposes. The Columbia River Estuary Data Development Program is a $6.2 million special program with a dual purpose: to increase the understanding of the Columbia river estuary as a system, and to acquire information needed for making specific land/water management decisions. It is anticipated that the inclusion of information provided by this interdisciplinary research effort in the Regional Tradeoffs Analysis Program will provide a solid basis for predicting impacts of varying instream flows on the Columbia River estuary. (Brambley-SRC)
W82-02155

COLORADO RIVER SIMULATION SYSTEM; AN EXECUTIVE SUMMARY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 6A.
W82-02170

A MONTHLY TIME SERIES MODEL OF MUNICIPAL WATER DEMAND,
Water and Power Resources Service, Provo, UT.
R. D. Hansen, and R. Narayanan.
Water Resources Bulletin, Vol 17, No 4, p 578-585, August, 1981. 3 Fig, 5 Tab, 16 Ref.

Descriptors: *Statistical models, *Water demand, *Time series analysis, Drinking water, Water dis-

tribution, Management planning, *Salt Lake City, Utah, Model studies.

The procedures and results of a time series analysis of factors which influence municipal water use in Salt Lake City, Utah, are presented. A multivariate time series model was formulated to study the monthly variation in municipal water demand, and a high multiple correlation coefficient and F-statistic were determined for the Salt Lake City application. Municipal water demand is determined by explanatory variables including price, average temperature, total precipitation, and percentage of daylight hours. In an ex post forecast, the model accurately predicted monthly variations. The model was also useful for predicting and studying the impact of non-structural management decisions such as the effects of price changes, peak load pricing methods, and other water conservation programs. When disaggregated time series water use data are available, the model can be applied to sector water demand data. (Small-FRC)
W82-02263

HYDROPOWER: UNTAPPED RESOURCE AND ENVIRONMENTAL HAZARD,
For primary bibliographic entry see Field 5C.
W82-02277

USER REACTION TO WILD AND SCENIC RIVER DESIGNATION,
Clemson Univ., SC. Coll. of Forest and Recreation Resources.
For primary bibliographic entry see Field 6G.
W82-02278

42-MILE WATER PIPELINE FOR COAL BOOM TOWN.
Public Works, Vol 112, No 2, p 82-83, February, 1981.

Descriptors: *Pipelines, *Steel pipes, *Water transport, Conveyance structures, Hydraulic structures, Water supply development, Water demand, Wells, Pumping plants, Water distribution, *Gillette, *Wyoming.

A 42-mile steel pipeline is under construction to supply water to 35,000 residents of the coal boom town of Gillette, Wyoming. Of the $23 million needed for the project, $12 million goes to construction, $7-$8-million is for materials, and the remainder will be used to drill eight water supply wells and construct two pump stations. The 30-inch diameter pipeline will be able to deliver 7,000 gpm to accommodate peak demands. Wall thicknesses of the 48-foot lengths range from 10-gauge to 1/4-inch. Sections of the piping are available in more than 5,500 lengths, determined by a computer system. The pipe will be shipped overland 1,150 miles from the Beall Pipe Division of Portland by truck. The contractor will use three construction crews in a leap-frogging maneuver for the bulk of the project. The average excavation depth is 8 to 10 feet, and in some spots V-shaped trenching is used. Color-coding of pipe ends provides for swift and errorless transporting and laying of pipe sections. (Geiger-FRC)
W82-02359

EMPHASIS ON DISTRIBUTION: STRATEGIES FOR SMALL SCALE WATER RESOURCES DEVELOPMENT IN THAILAND,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
For primary bibliographic entry see Field 6A.
W82-02408

AN EVALUATION OF THE POTENTIAL FOR WATER CONSERVATION AND REUSE IN THE GEORGIA PULP AND PAPER INDUSTRY,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
For primary bibliographic entry see Field 3E.
W82-02456

ESTIMATED WATER USE IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02482

ASSESSMENT OF EIGHTEEN PUBLIC GROUNDWATER SUPPLIES IN ILLINOIS,
Illinois State Geological Survey, Champaign.
For primary bibliographic entry see Field 2F.
W82-02510

RATE STRUCTURES AND DEMAND REDUCTION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 6C.
W82-02517

EFFICIENT GROUNDWATER UTILIZATION,
R. C. Heath.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 74-77. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Groundwater management, *Water supply development, *Long-term planning, Surface-groundwater relations, Aquifers, *Water supply, Aquifer management, Grants, Cost sharing, Economic aspects, Groundwater recharge, Water costs, *North Carolina, Projections, *Water demand.

The eastern half of North Carolina is occupied by the Coastal Plain, which contains abundant groundwater in sand and limestone aquifers and abundant surface water in major rivers that originate in the Piedmont to the west. However, groundwater levels in the deeper aquifers have been declining for more than two decades, which indicates that withdrawals and natural discharge are exceeding recharge. The development of a water management plan for the deep Coastal Plain aquifers will be one of the critical water issues in the eighties. In the Piedmont and Mountain area, there has been increasing dependence on surface-water supplies: the area's population is expected to double in the next 40 years and water use to triple. Water needs of North Carolina population and industry will require expansion of existing water supplies and the development of new supplies, both of which require federal and state assistance. In addition, conservation is needed to ensure reasonable water costs. Resources are necessary to determine how much groundwater can be developed and how to construct and test the wells needed to supply it. Assistance is available from the U.S. Geological Survey, which collects data on streamflow, groundwater, and water quality for use in the design of water systems. (Garrison-Omniplan)
W82-02520

6E. Water Law and Institutions

INSTITUTIONAL BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN THE SOUTHEAST - VOL I - TECHNICAL REPORT, PART I - INSTITUTIONAL BARRIERS,
Tennessee Univ., Knoxville. Graduate School of Planning.
G. E. Bowen, and T. R. Gangaware.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153537, Price codes: A09 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, May, 1981. 184 p, 1 Fig, 12 Tab. OWRT-C-90234-U(9434)(1), 14-34-0001-9434.

Descriptors: *Urban planning, *Water quality management, *Legal aspects, *Economic aspects, *Institutional constraints, Local governments, Water pollution, Legislation.

The primary objective of the study was to make comparisons and assessments of institutional barriers and inter-agency relationships which impaired the ability of 208 areawide agencies to develop acceptable comprehensive water quality management plans within the southeastern United States. A secondary objective of the study focused on an analysis of citizen participation mechanisms employed in the development of the 208 programs, in order to develop alternative approaches for enhancing general public input into water quality management programs. The study consisted of four interrelated phases: a comprehensive literature review, a questionnaire administered to 208 areawide agencies in the southeast, a series of case studies of selected 208 areawide agencies and the administration of a delphi process questionnaire to selected individuals. The seven 208 planning areas participating in the case study phase included: Asheville, NC; Columbia, SC; Chattanooga, TN; Miami, FL; Myrtle Beach, SC; Knoxville, TN; and Orlando, FL. The major institutional barriers identified fell under four major categories: legal, political/governmental, cultural, and economic. (Gangaware-Tenn)
W82-02101

INSTITUTIONAL BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN THE SOUTHEAST - VOL II - TECHNICAL REPORT, PART II - ISSUES, PROBLEMS, AND DATA,
Tennessee Univ., Knoxville. Graduate School of Planning.
G. E. Bowen, and T. R. Gangaware.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153545, Price codes: A09 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, May, 1981. 181 p, 1 Fig, 3 Tab, 8 Append. OWRT-C-90234-U(9434)(1), 14-34-0001-9434.

Descriptors: *Urban planning, *Water quality management, *Legal aspects, *Institutional constraints, Local government, Legislation, Water pollution, Citizen participation.

The second volume of the technical report contains eight appendices. This volume was intended to be a reference document for persons unfamiliar with many of the issues and problems associated with water quality planning and management. As a reference document, it contains information on regulatory features of the 208 program, legal background for water quality planning, a description of citizen participation techniques and a summary of the case studies. Also included in this volume are the results of the questionnaire and the delphi process. (Gangaware-Tenn)
W82-02102

LEGAL, ECONOMIC AND INSTITUTIONAL BARRIERS TO WATER REUSE IN NORTHERN NEW ENGLAND, BOSTON, MASSACHUSETTS,
Bracken and Baram, Boston, MA.
For primary bibliographic entry see Field 3C.
W82-02107

MANAGEMENT OF FRESHWATER INFLOW TO ESTUARIES: A LAWYER'S PERSPECTIVE,
Environmental Defense Fund, Inc., New York.
J. B. Tripp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 65-76, 1 Tab, 14 Ref.

Descriptors: *Water management, *Legal aspects, *Estuarine environment, *Water resource development, River flow, Flow discharge, Flood plain management, Groundwater runoff, Sediments, Wetlands.

The condition of surface and ground water inflows is of critical importance where the maintenance of restoration of the chemical, physical, and biologi-

cal functioning of an estuary is a recognized objective. Maintenance of freshwater inflow systems as part of an estuarine management program is hampered by three factors: Federal statutory programs which fail to recognize the interrelationships between riverine and estuarine systems; inadequate scientific knowledge of these relationships; and Federal water resource development programs that continue to promote massive alterations of riverine systems, including floodplain vegetation. Although existing statutory programs can be effective in controlling discharges of some pollutants into surface or ground waters entering estuaries, they are not so effective at controlling major alterations of fresh-water inflows, such as hydrologic modifications, alterations in sediment patterns and loss of riverine wetland floodplain vegetation, which affect estuaries. These legal constraints are also a reflection of the state of scientific knowledge about riverine-estuarine relationships. Increased scientific knowledge about these relationships will be useful in strengthening the effectiveness of existing programs to combat degradation of freshwater flows to estuaries. (Moore-SRC)
W82-02111

FEDERAL AND STATE COASTAL ZONE MANAGEMENT EFFORTS DIRECTED AT ESTUARIES AND FRESHWATER INFLOW,
National Oceanographic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. B. Mieremet.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 96-102, 1 Ref.

Descriptors: *Estuaries, *Water management, *Coastal zone management, *Government interrelations, Economic aspects, River flow, Environmental effects, Salinity, Priorities.

The Coastal Zone Management Act was passed because of concerns over estuaries and other coastal resources. Financial assistance and management tools are providing incentives to state and local governments to begin to address problems associated with freshwater inflows or the lack thereof. Special area management planning, enforceable policies, and improved coordination are being brought to bear on the decisionmaking process. Mitigation and restoration projects can help alleviate some of the past problems. While coastal zone management has many significant tools which are being used and will be used in the future to address problems relating to freshwater inflows to estuaries, it obviously can not cure them all. Some states have included all or almost all of their state as the coastal zone because of the watershed principle, while others stop at the 5 ppt salinity line of the estuary. Extra efforts are needed to ensure good coordination of government actions. Coastal zone management often requires some compromises between preservation and development. It is likely that there will be times when the importance of freshwater inflow will get lost in the priorities where there are conflicting interests. (Moore-SRC)
W82-02113

REVIEW OF ESTUARINE-RELATED PROJECTS BY THE GULF OF MEXICO FISHERY MANAGEMENT COUNCIL,
Gulf of Mexico Fishery Management Council, Tampa, FL.
For primary bibliographic entry see Field 6G.
W82-02146

AN OVERVIEW OF TEXAS LAW, POLICY, AND AGENCY ACTIONS CONCERNING ESTUARINE INFLOW,
Wildlife Management Inst., Dripping Springs, TX.
M. T. Walton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 255-269. 52 Ref.

Descriptors: *Estuaries, *Legislation, *Jurisdiction, *Environmental protection, *Water demand, *Water use, Environmental policy, Permits, Priorities, Water management, Appropriation, *Texas, Water law.

Texas water law has been influenced by several legal traditions, but only in 1975 was a law passed which recognized the need to preserve estuarine inflow and authorized studies to determine inflow needs. The law is administered by the Water Rights Commission. However, the law has not been applied towards the development of an active policy or in strong agency action to preserve estuarine inflows. In three cases the Commission allowed permits for projects in which estuarine inflows were not assured. The Texas Parks and Wildlife Department has participated in permit hearings and adjudication this participation has declined, and to some extent has been taken over by the Department of Water Resources. This department has provided a data base on which to base reservation of freshwater inflos. These inflows have the lowest priority of all demands on water resources. Neither the Texas Water Plan nor the Texas Coastal Management Plan has definite provisions for estuarine inflow preservation. Since some basins are already overappropriated, and each new appropriation has an environmental effect, strong defense of the present law and additional regulations would seem to be necessary. (Brambley-SRC)
W82-02154

SCIENTIFIC PROGRESS AND DETERIORATING ECOSYSTEMS; SAN FRANCISCO BAY AND THE 1970'S,
Fish and Wildlife Service, Sacramento, CA.
P. A. Meyer, and W. T. Davoren.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 277-287. 27 Ref.

Descriptors: *San Francisco Bay, California, *Ecosystems, *Estuaries, *Bays, *Water supply, *River flow, Environmental effects, Selective withdrawal, Legislation, Water quality, Shore protection, Data acquisition, Prediction.

Considerable progress has been made by planners, scientists, and environmental managers of the 1970's in identifying the uncertain and to a considerable degree unquantifiable, nature of bay/estuary ecosystems, and in offering improved prescriptions for their protection. At the same time, this progress in understanding theory and making prescriptions has been accompanied by continued stressing of the bay systems and in some instances by their further deterioration. In the San Francisco Bay area these stresses have resulted from continued and increased upstream withdrawals, and it is projected that these withdrawals will continue. No gains were made in the bay fill and shoreline control programs, and San Francisco Bay was excluded from jurisdiction of applicable legislation. Municipal and industrial discharges to the bay were reduced as a result of applying national and state programs, rather than as a response to the needs of the bay. It is proposed that studies be conducted with emphasis on the metaphysical or value relationships of the bay, instead of the procedural or practical, and that studies be sponsored by persons other than those who have a direct interest in the outcome. (Brambley-SRC)
W82-02156

DECISION-MAKING CONSTRAINTS IN THE POLICY DEVELOPMENT AND ADMINISTRATION OF WATER RESOURCES IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
D. G. Williams, and D. C. Menzel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153701, Price codes: A04 in paper copy, A01 in microfiche. Information Report 16, 1981. 65 p, 2 Fig, 20 Tab, 37 Ref, 2 Append. OWRT-A-032-WVA(4), 14-34-0001-7103.

Descriptors: *Administrative decisions, Attitudes, *Decision making, *Judicial decisions, Motivation, *Policy making, *Political constraints, *West Virginia, Administrative regulation, Institutional constraints, Law enforcement, Legal aspects, Legislation, Political aspects, Public policy, Social aspects, Water law, Water policy.

This study investigated the decision-making constraints of water-resource policy and administration in West Virginia. The findings indicate that internal administrative processes and organizational arrangements often tend to hamper coordination and fragment responsibility. Much of the policy enforcement machinery is dependent on those who operate in a context not supportive of the policy and over whom the responsible organization has no direction. The findings also indicate that water-quality management is in competition with many other policy areas at the gubernatorial level. A survey of state lawmakers revealed that legislators perceive the state to place a lower priority on environmental protection compared to education, highways, health, and labor. Legislators perceived the state executive to assign water-pollution control in particular to the middle of other environmental priorities. With respect to the priorities of the legislators themselves, environmental problems and water pollution were ranked higher. Legislators evaluated water-pollution-control laws as adequate but enforcement as less than adequate. The survey of state legislators also indicated that legislative expertise and leadership are not well developed in the water-resource field.
W82-02173

ASSESSMENT OF THE NATIONAL WATER QUALITY MANAGEMENT PROGRAM, VOL. I, 106 PROGRAM OVERVIEW, PLANNING AND STANDARDS.
Association of State and Interstate Water Pollution Control Administrators, Washington, DC.
August 1981. 38 p, 1 Fig, 3 Tab.

Descriptors: *State jurisdiction, *Water quality standards, *Federal jurisdiction, *Waterpollution prevention, Public policy, Dredging, Political aspects, Hazardous materials, Law enforcement, Legal aspects, Water quality.

This report recommends reforms in the Federal Clean Water Act as a means of coping with declining program resources and increasing requirements. The ASIWPCA recommends that administration of the Clean Water Act be delegated to states, and federal efforts should focus on results, not procedures, but should continue to provide $118 million in the funding estimated to be needed for the states to administer the Act. In terms of water quality, it is recommended that there be a simplified standards-setting process to expedite the development of reasonable standards at minimal costs. States should have the primary role in establishing standards, with the burden of proof for disapproval of state water quality standards resting with the U.S. Environmental Protection Agency. Water quality standards should be reviewed and revised on a five-year cycle, and toxicity criteria should be established in cases where there are harmful presences and when public health is endangered. States should have the opportunity for input to federally negotiated international treaties where they will be expected to implement the agreements. The water quality management planning process, supported under Section 208 of the Clean Water Act, should be integrated with other elements of the water program, e.g., 303(e) of the Act, which concerns basin planning. Regarding clean lakes, funding emphasis should be placed on lake restoration to preserve lakes identified in each state. Section 404, which establishes a permit program for discharge of dredge and fill materials, is

viable only with adequate funding to ascertain environmental, water quality and economic needs. (Garrison-Omniplan)
W82-02181

ASSESSMENT OF THE NATIONAL WATER QUALITY MANAGEMENT PROGRAM, VOLUME 2: CONSTRUCTION GRANTS.
Association of State and Interstate Water Pollution Control Administrators, Washington, DC.
August, 1981. 71 p, 7 Fig, 7 Tab.

Descriptors: *Grants, *Wastewater treatment, *Engineering, *Sanitary engineering, *Government finance, Project planning, Government supports, Municipal wastes, Municipal wastewater, Wastewater treatment, Economic justification, Economic aspects.

The Construction Grants Program grew out of the recognition that inadequate municipal sewage treatment was a major cause of the nation's water pollution. However, the program has been plagued with financial instability. The Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) recommends that Congress provide adequate multi-year authorizations and advance appropriations consistent with the rate of progress desired, mandated cleanup deadlines and national fiscal constraints. The Association also recommends that the multi-year funding system should consider actual overall water pollution control needs within each state and the rate at which locally developed projects are expected to need funding. ASIWPCA advocates maintaining 205(g) funding at a level of at least $100 million per year and limiting use to those activities currently eligible for 205(g) funding. These funds should not be required by the Federal government to be used as a substitute for inadequate 106 or 208 funds. Other recommendations are: (1) delegated states should be provided more freedom and flexibility in determining and approving construction grant projects; (2) the U.S. Environmental Protection Agency should delegate to the regional level the authority to approve deviations to grant regulations upon justification from states; (3) advanced treatment review should be conducted at the state level rather than the federal level; (4) statistics used for formula data must have proven validity; (5) reserve treatment plant capacity to year 2000 population should remain eligible for federal financing. (Garrison-Omniplan)
W82-02182

ASSESSMENT OF THE NATIONAL WATER QUALITY MANAGEMENT PROGRAM, VOLUME 3: INDUSTRIAL AND MUNICIPAL CONTROL.
Association of State and Interstate Water Pollution Control Administrators, Washington, DC.
August, 1981. 35 p.

Descriptors: Municipal wastes, Industrial wastes, *Wastewater treatment, *State jurisdiction, *Federal jurisdiction, *Political aspects, Municipal wastewater, Legal aspects, Government finance, Economic aspects, Administrative agencies, Administrative decisions, Effluents.

Control of municipal and industrial point sources of pollution, together with Construction Grants Management, comprise the major part of the State water programs. The Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) examined the status of the water program regulated by the Clean Water Act and concluded that coordination of the National Pollutant Discharge Elimination System (NPDES) between the states and the U.S. Environmental Protection Agency is in need of reform. The recommendations are: (1) the 1983 goal of fishable/swimmable waters should be extended to the year 1990, and zero discharge should be considered an unrealistic goal; (2) EPA review of individual state actions should be replaced with auditing for results; (3) substantial streamlining of the NPDES program should include deregulation of deminimous sources, elimination of national public participation requirements, and streamlining of EPA compliance and enforcement procedures; (4) primary enforcement authority should be exercised by states; (5) local governments that have attempted to comply with current deadlines should not be penalized for delays encountered for lack of construction grant funds; (5) compliance evaluation should focus on substantial violations of water quality standards and effluent limitations; (6) the EPA should continue developing national categorical standards for pretreatment to be imposed only when states do not choose to use their own program equivalent; (7) influent, effluent and sludge from publicly owned treatment works (POTWs) should be characterized by states and POTWs, and the baseline industrial survey continued. (Garrison-Omniplan)
W82-02183

SUPERFUND: WHAT A MESS,
Chelsea International Corp., Washington, DC.
W. C. Savage.
Association of State and Interstate Water Pollution Control Administrators, Washington, DC., August 12, 1980. 12 p, Append.

Descriptors: *Hazardous materials, Pollutants, *Legislation, *Liability, *Federal jurisdiction, *State jurisdiction, Decontamination, Economic aspects, legal aspects, Cleaning, Cleanup, Political aspects, Contamination.

On June 13, 1979, the Carter Administration released a proposal to amend the Clean Water Act and the Solid Waste Disposal Act. The proposal would establish liability and compensation systems to respond to health and environmental damages caused by oil and hazardous waste spills. The administration's proposal along with initiatives introduced by other congressmen have been partially included into three 'Superfund' bills now seriously being considered by Congress: HR 85, HR 7020, and S 1480. All three bills proposed the establishment of a large fund to assure swift response to pollution incidents using funds from chemical and oil company fees or taxes on production, and all allow delegation of authority to the states. Important differences are that HR 85 establishes two funds--one for oil spills and one for hazardous substance spills; HR 7020 and S 1480 limit liability to the proportional share of causation; S 1480 does notinclude oil spills and has no limits on liability, but provides victims access to Federal courts with initial presumption in their favor to avoid premature dismissal of cases. The bills vary widely in the level of autyority delegated to states. Liability provisions, fund size, and mechanisms for disbursing the funds are being debated. EPA's estimates to clean up abandoned sites alone range from $38 to $44 B. At the time of writing, it appeared unlikely that Superfund legislation would be passed in the Congressional session in progress, since only 35 days remained and jurisdictional disagreements might not be settled in time. Whatever legislation is passed, the question is raised whether the EPA can handle another major law. (Garrison-Omniplan)
W82-02184

COMPLIANCE STRATEGY FOR CLEAN WATER.
Association of State and Interstate Water Pollution Control Administrators, Washington, DC.
May, 1981. 8 p.

Descriptors: *Legislation, *Federal jurisdiction, *Water quality standards, Water pollution prevention, Waste treatment facilities, Wastewater facilities, Pretreatment of water, Industrial wastes, Water treatment, Economic aspects, Grants, Hazardous materials, Pretreatment standards.

This paper presents ASIWPCA's compliance strategy for three principal aspects of the Federal Clean Water Act: (1) publicly owned treatment works (POTWs), (2) industrial dischargers, and (3) pretreatment (indirect industrial sources). The suggested strategy for POTWs includes maintaining the funding for construction grants through the FY82 appropriation period, and allowing states the option of reducing the federal cost share to less than 75 percent of the eligible project cost. The EPA should redefine 'secondary treatment' to eliminate the present 85-percent removal of pollutant requirement and allow the maximum range of treatment technologies to be utilized. Provisions in Section 205(g) should be structured so that states continue to receive funding under state management assistance grants of at least $100 million per year. POTWs should be able to derive their compliance requirements of effluent limitations and schedules from approved state strategies to ensure coordination with the permit process and the availability of construction grant funds. Industrial dischargers should continue to be required to follow 'BTP' based controls as the minimum national treatment requirement. However, the approach for 'BCT' should be modified for conventional pollutants to include water quality based equivalency determinations for treatment. EPA should develop national categorical standards for 'BAT' to improve control of toxic pollutants. National categorical standards for pretreatment should be developed by EPA, but some states should be waived from pretreatment requirements when other controls are adequate. (Garrison-Omniplan)
W82-02185

INDUSTRIAL PRETREATMENT NEEDS TO BE OVERHAULED AT THE NATIONAL LEVEL.
For primary bibliographic entry see Field 5D.
W82-02198

LAKE TAHOE PRESERVATION BILL ENACTED.
National Parks, Vol 55, No 2, p 23, February, 1981.

Descriptors: *Lake Tahoe, *Legislation, *Watershed management, Legal aspects, Water law.

Legislation was enacted to preserve Lake Tahoe (PL96-586) during the closing days of the 96th Congress. The bill provided for the sale of Bureau of Land Management property around Las Vegas, with 85% of the proceeds from the sales to be used to buy land in the Lake Tahoe Basin. The bill was weakened by two amendments. The first removed the Secretary of Agriculture's authority to acquire lands to protect air and visual qualities. The second required that before any land could be condemned, the Tahoe Regional Planning Agency would have to concur. The bill is a positive step toward resolving the lake's problems. (Small-FRC)
W82-02244

ADJUSTING GOVERNMENT ROLE IN WATER LAW.
Southwest and Texas Water Works Journal, Vol 63, No 7, p 10-11, October, 1981.

Descriptors: *Water policy, *Government supports, *Financing, Water quality control, Water law, Government finance, Grants, *Arkansas.

Changing water policy as applied to Arkansas was the subject of a talk by Congressman J. P. Hammerschmidt before the Arkansas Water Managers Association August 1981 meeting. The Water Policy Board proposed in H. R. 3432 is intended to enhance state-federal cooperation for all water policy issues. A major help in meeting national and Arkansas water quality goals has been the Clean Water Act's Contruction Grants Program, which helps fund sewage treatment works up to 75% (formerly limited to 30%). Under this program Arkansas received $114 million toward compltion of 193 projects, with another $114 proposed for 147 active projects. Under the new administration, regulatory reform and cost cutting have begun. Less money will be availale from the federal government. Therefore local governments willhave to consider other long-term options for local projects. Grants for Arkansas for 1982 have been cut from $5.2 million to $2.3 million and loans from $17 million to $6.9 million. The Congressman pledged cooperation in developing workable, reasonable, practical federal water policy during the national period of reevaluation. (Cassar-FRC)
W82-02256

SUPREME COURT CLARIFIES WATER ACT REQUIREMENT,
M. R. Higgins.
Natural Resources Journal, Vol 21, No 3, p 607-616, July, 1981.

Descriptors: *Judicial decisions, *Water pollution control, *Effluent standards, Federal Water Pollution Control Act, Legal aspects, Water law, Water pollution prevention, Quarries, Environmental Protection Agency v. National Crushed Stone Association, Supreme Court.

In EPA v. National Crushed Stone Association, the Supreme Court upheld that the EPA was not required to consider the economic effect of the effluent limitation standards on the individual plants requesting variances from the first-phase or Best Practicable Technology (BPT) standards. The Court supported Congress' conclusion that water pollution prevention and control must be accomplished in spite of some possible plant closings. The Court decision narrows the possibilities for obtaining BPT variances while allowing enough flexibility to handle individual situations not considered when the EPA drew up the first-phase regulations. (Cassar-FRC)
W82-02257

DO STATE WATER ANTI-EXPORTATION STATUTES VIOLATE THE COMMERCE CLAUSE. OR WILL NEW MEXICO'S EMBARGO LAW HOLD WATER,
C. B. Stetson.
Natural Resources Journal, Vol 21, No 3, p 617-630, July, 1981. 93 Ref.

Descriptors: *Water resources development, *State jurisdiction, Legal aspects, Export, Water demand, Water supply, *New Mexico, Water transfer.

At least 14 states and the District of Columbia have statutes directly prohibiting or regulating the export of state water, while other statutes indirectly regulate such export by narrow definitions of beneficial use or by legislation designed to protect the needs of the area in which the water originates. Increased demands for water and conflicting water law principles of neighboring states lend an element of tension to the water confrontation. The outcome of a suit filed by the city of El Paso against the New Mexico State Engineer, may be a landmark decision in the field of natural resources law as water supplies continue to dwindle, demands continue to increase, and states become even more concerned with protecting their citizens and conserving their local resources. After reviewing several other decisions as well as state property rights, it is concluded that any water rights in New Mexico which were vested prior to the passage of the non-exportation statute of 1953 could not be retroactively changed or controlled without state proof that such control is needed for the public good. However, prospective non-exportation statutes may be valid if they meet the following criteria: the sovereign power encompasses state waters, there is strong local interest in restricting exports, the legislation is non-discriminatory, and the Congress has not pre-empted the field. The New Mexico statute being challenged at present does not prohibit the exportation of all water, merely groundwater, and even that prohibition is not absolute, as it allows for the exportation of groundwater for designated uses. (Baker-FRC)
W82-02279

WATER RIGHTS ON INDIAN ALLOTMENTS,
D. H. Getches.
South Dakota Law Review, Vol 26, No 3, p 405-433, Summer, 1981.

Descriptors: *Water rights, *Allotments, *Indians, Water law, Water policy, Reservation doctrine, Political aspects, Social aspects, Legal aspects, Appropriation, Treaties, Judicial decisions, Leases.

Water rights on parcels of Indian reservation land allotted or leased to individuals are not expressly defined by any statute or other source. A problem developed when individual lots were leased to Indians for agricultural development, lease, or sale. Surplus lands on the reservations were opened to non-Indians for homesteading. The courts have long recognized that Indian tribes have special reserved water rights, exempt from state law and the requirements for continuous use. This paper concludes that no reserved rights may be held by individuals, but the allotees may use some of the rights during the period of trust. A solution in harmony with the objective of the General Alotment Act and Indian treaties would recognize that allotted land passing out of a trust period has water rights based on the dates and quantities of appropriations made on the land during the trust period. (Cassar-FRC)
W82-02363

DISPOSAL OF INDUSTRIAL EFFLUENTS - SOME FUTURE PROBLEMS,
Binnie and Partners, London (England).
For primary bibliographic entry see Field 5D.
W82-02405

THE EFFECT OF EEC DIRECTIVES ON WATER SUPPLIES,
A. W. Kenny.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 42-49, January, 1980. 8 Ref.

Descriptors: *Water supply, *Administration, *Operating policies, *Economic effects, *Water pollution, Rivers, Effluent limitations, Water quality, Drinking water, Trace elements, Pollutants, Contamination, Water treatment, Cost analysis, *Europe.

The First Environmental Programme of the EEC (European Economic Community) is described. In regard to the aqueous environment, it provides for (1) standardization of methods of sampling and analysis; (2) preparation of objectives; (3) determination of standards for pollutants; (4) harmonization of measures to combat pollution from certain industries; (5) measures to eliminate toxic or persistent waste; and (6) measures to combat pollution in certain zones of common interest. Additional directives address trace substances, drinking waters, and industrial effluents. These are areas where agreement among the member States has been relatively easy and unpublicized. More controversial measures will be dealt with in the future. (Titus-FRC)
W82-02432

ANALYSIS OF FIRM WATER SUPPLY UNDER COMPLEX INSTITUTIONAL CONSTRAINTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-02501

REASONABLE GROUNDWATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: THE LAW AND UNDERLYING ECONOMIC GOALS,
D. L. Grant.
Natural Resources Journal, Vol 21, No 1, p 1-36, 1981. 170 Ref. OWRT-A-066-IDA(2), 14-34-0001-0114.

Descriptors: *Legal aspects, *Water rights, Legislation, Cost-benefit analysis, *Groundwater management, Wells, *Pumping, Groundwater.

Two extreme approaches exist to the groundwater pumping level issue. The first is that well owners have no protection whatsoever in their diversion systems and each must pay his own cost of coping with declining levels. According to the second, existing appropriators are absolutely protected in their historic diversion systems and have injunctive or damage remedies against interference by junior users. Today, the appropriation doctrine states (western United States) have opted for a middle ground of reasonable pumping level standard. Modern resource allocation literature recognizes the impact on allocation decisions of social goals, as well as the economic efficiency considerations. Hydrologic aspects of the pumping level issue must be considered along with available groundwater management tools and the diverse factual situations in which pumping level problems can arise. Overall, the existing pumping level statutes are incomplete in listing factors, weighting them, and declaring specific policy. Further guidance on economic and other factors must be obtained by searching for the goals that underlie the statutes and by drawing on ancillary statutes. (Baker-FRC)
W82-02503

MUNICIPAL NEEDS,
North Carolina League of Municipalities, Raleigh.
D. Reynolds.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 6-9. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Municipal water, *Long-term planning, *Regional planning, Projections, Jurisdiction, Administrative decisions, Decision making, Water resources development, Potential water supply, Economic aspects, Site selection, Groundwater management, *North Carolina.

Local governments need the assistance of state and federal agencies to provide clean water, to protect and preserve current water supply sources, and to regenerate those that are below standard. Five major municipal needs are: (1) Statewide planning. Local governments depend on states to provide comprehensive water resource planning programs with a mechanism to reserve prime impoundment sites for future use and a coordination of groundwater resources. (2) An advocacy role regarding local municipalities. When the state adopts this stance rather than one of a regulator, problems can be solved more quickly and costly delays in project schedules can be avoided. (3) Project scoping and planning. States can develop broad plans of action with individual steps identified to assist local government decision makers who may have limited staff or lack of knowledge of state and federal agencies. This type of broad outline will greatly increase the probability of success of projects. (4) Technical assistance. This could include training of water treatment plant operators to assist them in keeping pace with changing technology, or assistance in meeting the requirements of the Safe Drinking Water Act, in identifying conservation benefits, and in developing programs to implement conservation. (5) Funding assistance. Municipalities need help in identifying sources of grants and funds and making maximum use of those available. (Garrison-Omniplan)
W82-02513

RECYCLING,
North Carolina Department of Natural Resources and Community Development, Division of Environmental Management.
C. Batten.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 25-27. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Recycling, Waste recovery, *Water reuse, *Wastewater renovation, Municipal wastewater, Industrial wastewater, Water use, Grants, Economic aspects, Planning, Political aspects, Reclaimed water, Water reclamation, *North Carolina.

Water conservation and wastewater reuse and recycling have generated great interest in recent years because of a shortage in water supply, the high cost of wastewater treatment and disposal, and federal funding incentives for recycling and reuse. In the 1977 Amendments to the Federal Water Pollution Control Act of 1972, 2 percent of funding was set aside to provide a 10 percent bonus grant for 'innovative' and 'alternative' projects; the latter were defined as proven methods for reclaiming and reusing water, recycling wastewater constituents, eliminating pollution discharge, or recovering energy. The alternative process most used in North Carolina has been the land application of wastewater. Two projects are

in operation, three or four are funded, and about twelve more are in the proposal stage. The recycling of wastewater involves the need for an administrative and legal framework, economies in recycling and reuse, the risk to public health, and the social impact. A project under review for recycling in North Carolina would cost about $350,000 and involve the use of wastewater effluent as a scrubber for an incinerator. A possible type of project for the future is deep-well injection to reduce salt-water encroachment. Industrial wastewater recycling has had a better record than that of municipal wastewater. (Garrison-Omniplan)
W82-02514

APPALACHIAN REGIONAL COMMISSION AND THE COASTAL PLAINS REGIONAL COMMISSION,
North Carolina Department of Natural Resources and Community Development, Office of Intergovernmental Relations.
J. Booth.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance, 1980. p 33-35. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Grants, *Financing, *Municipal water, *State jurisdiction, *Economic feasibility, Public investment, Legislation, Federal jurisdiction, Political aspects, Economic aspects, Regional planning, Planning, *North Carolina.

This report summarizes the federal grant programs administered by the Office of Intergovernmental Relations in North Carolina. Four major programs are: the HUD 701 Comprehensive Planning Program, which encompasses the regional planning activities of Councils of Government and regional planning commissions; the Appalachian Regional Commission (ARC), which operates in 29 western counties; the Coastal Plains Regional Commission, which operates in 45 eastern counties; and Section 304 of the Economic Development Administration (EDA), which makes a small discretionary fund available to each state governor to supplement selected EDA grants. Federal budget cuts may seriously affect some of these, such as the ARC, which was funded for $41 million in FY 81 but is marked for zero funding in FY 82, although a funding extension may carry them until September 1981. The CPRC is tied in with EDA legislation that is in effect only until December 1980; its future is also unclear. In all of the programs, the basic philosophy and priorities are for projects related to economic development, such as water-line extensions to an industrial park or a future industrial site. Both the ARC and CPRC programs supplement community development activities by providing a maximum of 80 percent total federal funding after other sources are already signed on to a local project. (Garrison-Omniplan)
W82-02515

TRENDS IN STATE AND FEDERAL POLICY ON WATER SUPPLY MANAGEMENT,
North Carolina Department of Natural Resources and Community Development, Office of Water Resources.
J. Morris.
In: Proceedings of North Carolina Conference on Water Savings and Water Supply Assistance. 1980. p 43-51. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: Grants, Long-term planning, Economic aspects, *Cost-sharing, *Regional planning, *Resources development, Federal jurisdiction, Public policy, *Water policy, Jurisdiction, River basins, River regulations, Political aspects, *North Carolina, Water supply, *Water management.

The manner in which state and federal assistance is given to local water supply agencies is very much under re-examination. On the state level, a study carried out in North Carolina by the Legislative Commission on Alternatives for Water Management yielded the conclusion that regional water management has many benefits and can be organized in two ways: A state water authority could develop water supplies and provide wholesale supplies to local governments, or a river basin commission could be created in each of the state's major river basins which would have water management responsibilities and some taxing or revenue-raising powers. Another priority on the state wells is for the legislature to review the future of the Clean Water Bond program, so communities know what funding they might expect. On the federal level, President Carter's water policy incorporated water conservation regulations and incentives in almost all federal programs that have any impact on water supply or water storage. The current picture on water policy is uncertain because there is a difference of opinion as to the value of grants to local agencies. One view is that local agencies need to be self-sufficient. Another is reflected in the Domenici-Moynihan bill, S.1641, which provides flexibility on the state level and perhaps less red tape in Washington. The paper reviews pending legislation in Congress and possibilities for federal funding of local projects, as well as changing attitudes about various approaches to water management at the federal level.
W82-02516

NEW DEVELOPMENTS IN WATER RESOURCES MANAGEMENT FOR LOCAL GOVERNMENTS AND INDUSTRIES,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
F. J. Smith.
In: Proceedings of North Carclina Conference on Water Savings and Water Supply Assistance, 1980. p 84-94, 6 Tab. North Carolina Department of Natural Resources and Community Development, Raleigh.

Descriptors: *Water resources development, *Administrative regulations, *Public opinion, Public policy, Water quality management, Water supply development, *Water conservation, Grants, Water permits, Federal jurisdiction, Quality control, Management planning, State jurisdiction, *North Carolina, *Water management.

Surveys of water managers and industrial and residential users in 54 North Carolina communities reveal that the highest-ranking problem for users is water quality; management is more concerned with water-supply expansion and difficulties with state and federal water authorities. While it is not entirely surprising that water professionals have a different view of water problems than water users, it is important that water management understand those differences. There were some misperceptions by water managers regarding community attitudes on fundamental issues of water management; with training, managers can identify citizen priorities. Conservation activities were numerous in the communities surveyed. The most welcome and useful technical assistance provided to local water managers is nonstructural in nature, such as for grantsmanship, regulatory compliance, permit applications, personnel training, and general system improvements such as leak detection and quality control. There is some wariness among water users toward inviting such assistance, particularly from public agencies that also have regulatory functions. A modern water management information system was developed that (1) enumerated information elements relevant to water system planning and operations, (2) categorized information in general systems concepts, and (3) submitted categorized information to the 54 water system managers for evaluation. It was found that overall information to support comprehensive water management planning is most needed. (Garrison-Omniplan)
W82-02522

SOME ECONOMIC IMPACTS OF FRESHWATER STREAM EFFLUENT DISCHARGE LIMITS ON SELECTED SMALL COMMUNITIES IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Div. of Business Research.
For primary bibliographic entry see Field 5D.
W82-02530

WATER LAW, WATER CONSERVATION AND THE DEVELOPMENT OF ENERGY RESOURCES IN THE COASTAL, OFFSHORE AND FLOOD PLAIN AREAS OF ALABAMA,
Alabama Univ., University. School of Law.
For primary bibliographic entry see Field 5G.
W82-02535

MANAGEMENT OF INTERSTATE AQUIFER SYSTEMS,
Camp Dresser and McKee, Inc., Walnut Creek, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W82-02578

SALINITY FORUM: WHAT, HOW, WHY,
Utah Div. of Water Resources, Salt Lake City.
D. F. Lawrence, and B. C. Saunders.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 453-459, October, 1981. 1 Fig.

Descriptors: *Saline water, *Water policy, *Water quality control, *Colorado River Basin, Political aspects, Legal aspects, Institutions, Irrigation water, Mexican Water Treaty, Water quality standards, Legislation, Regional planning, Planning, River basins, Water management.

The Colorado River Basin Salinity Forum, an interstate organization, was created in 1972 to consider the problem of salinity, experienced in the lower basin but caused by withdrawals and return irrigation water in the upper basin. The forum's initial task was to establish numerical criteria for salinity in the basin and to develop a plan of implementation to meet the water quality criteria. It became apparent that the goal could be reached by: (1) minimizing salt pickup from future developments and (2) reducing present salt inflow to the system from natural and man-made sources. Although future development can be easily regulated by design criteria, alteration of existing projects would require substantial funds. The Salinity Control Act authorized construction of salinity control projects with 75% federal money and 25% from the states. The forum-recommended water quality standards and implementation plan were adopted by the states and approved by the EPA. Presently the forum monitors all salinity control programs, develops policy statements, and assists the EPA in defense of state salinity standards. The forum has been successful in spite of the conflicting interests of the seven states involved because all members are committed to a clearly-defined mission. (Cassar-FRC)
W82-02587

6F. Nonstructural Alternatives

STRATEGIES FOR THE MANAGEMENT OF ESTUARIES,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. M. Darnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche.
In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 434-447. 6 Fig, 1 Tab, 5 Ref.

Descriptors: *Estuarine environment, *Environmental policy, *Management planning, *Ecosystems, Salinity, Institutional constraints, Legislation, Jurisdiction, Environmental effects, Water quality.

Nationwide, the quality of estuaries has declined, and management strategies are required to restore their quality to past levels. The estuarine manager is the central figure in the system, receiving information from a variety of sources to formulate policy decisions and operation decisions, and initiating action which may be regulation (passive) or intervention (active). Both regulation and intervention may be directed to local or upstream conditions. These actions may be in the form of zoning, permits, or lease and purchase. The goal of a

healthy estuarine environment requires that conditions be maintained for those organisms that require low salinity, high salinity, are intermediate or tolerant of a range of salinities, and those which migrate through the estuary. The achieving of these goals is hindered by the absence of authorities with unambiguous control over estuaries, absence of legal tools for use by agencies, and absence of information on individual estuaries and watersheds. Because of the interstate nature of estuaries, there must be strong Federal involvement in their management. In the absence of such involvement, it is essential that the estuarine effects of upstream developments be considered in environmental impact statements, and that the cumulative effects of many small projects be considered. (Brambley-SRC)
W82-02166

INTERACTIVE NONSTRUCTURAL FLOOD-CONTROL PLANNING,
Hydrologic Engineering Center, Davis, CA.
D. T. Ford.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No. WR-2, p 351-363, October, 1981. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Alternative planning, *Flood control, *Computer programs, Flood damage, Flood plain management, Flood protection, Data storage and retrieval, Information systems, Planning, Flood insurance, Nonstructural alternatives, Cost-benefit analysis, Santa Fe, New Mexico.

The Nonstructural Analysis Package, developed by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, reduces the data handling time in the evaluation of nonstructural flood control alternatives. The package consists of two computer programs. The preprocessor program manipulates hydrologic, hydraulic, economic, and engineering data to derive indices that quantify the existing flood hazard for each structure or group of structures, as well as creates a random access data bank organized by stream reaches. The Interactive Analysis program retrieves, displays, and manipulates data and recomputes the flood hazard indices for evaluation. The method is illustrated with the Santa Fe, New Mexico, nonstructural flood control plan. It was easily used by persons with little computer utilization experience. The rapidly-produced alternatives were evaluated for social and political feasibility by the user, based on information gathered from persons living in the affected area. The recommended flood control plan obtained from this procedure is: (1) remove certain flood plain structures and covert property to park land, (2) replace two bridges, (3) clear the river channel in selected places, (4) construct a park walking wall, (5) construct small walls around certain structures, (6) buy flood insurance, (7) regulate flood plain land, and (8) plan for assistance in future floods. Although the expected cost of implementing the measures is $540,000 and the present value of damages is $266,000, elements of the plan were recommended for implementation. (Cassar-FRC)
W82-02320

AN ASSESSMENT OF CURRENT STANDARDS FOR SELENIUM IN DRINKING WATER,
Kirkham Michael and Associates, Omaha, NE.
M. J. Hammer.
Ground Water, Vol 19, No 4, p 366-369, July/August, 1981. 22 Ref.

Descriptors: *Selenium, *Drinking water, *Water quality standards, Reviews, Standards, Trace metals, Water treatment, Toxicity, Public health, Water pollution effects, Water pollution sources.

Current standards for selenium in drinking water, 10 micrograms per liter, are too stringent, according to a study of published literature on health effects of Se and the distribution of Se in natural waters. Although both deficiency and toxicity of Se are possible, neither is apparent in the U.S. population. The National Academy of Sciences recommends a provisional daily allowance of 50-200 micrograms per day. The average daily intake of Se by the American population is estimated at 200 micrograms per day. Minor health affects may appear at an intake of 500 micrograms per liter per day. The only known case of human poisoning from Se in drinking water occurred in an isolated family whose water supply contained 9 mg per liter Se. Their symptoms of lassitude, hair loss, and fingernail abnormalities disappeared upon changing water supplies. Se occurs naturally in foods, e.g., at up to 5 mg per kg in bread. In 43 samples of municipal water, Se levels ranged from 0.1 to 400 micrograms per liter. One well in Nebraska had a concentration of 480 micrograms per liter. Se cannot be effectively removed from water by conventional treatment methods; ion exchange, reverse osmosis, and electrodialysis are satisfactory, but prohibitively expensive. (Cassar-FRC)
W82-02372

EFFLUENT CHARGING SYSTEMS AND THEIR ADMINISTRATIVE IMPLICATIONS,
Environmental Resources Ltd., London (England).
For primary bibliographic entry see Field 6C.
W82-02403

DEVELOPING DAM-BREAK FLOOD ZONE ORDINANCE,
Corps of Engineers, Savannah, GA.
G. F. McMahon.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 461-476, October, 1981. 3 Tab, 29 Ref.

Descriptors: *Flood plain zoning, *Model studies, *Flood forecasting, *Ordinances, Flood plain management, Flood plains, Flood hydrographs, Dams, Flood routing, Flood waves, Flood spreading, Legal aspects, Nonstructural alternatives, Planning, Dam failure.

The formulation and enforcement of dam-break flood zone ordinances in Gwinett County, Georgia, will entail new problems not usually found in typical flood-zone regulations. The problems will occur as a result of inexperience in developing and interpreting ordinances, nonstandardization of methods and assumptions utilized to delineate dam-break flood zones, and conflicts of interest in the zoning process. The Georgia Safe Dams Task Force has tried to implement practical standards for estimating dam-break flood zones for a number of dams. Guidelines for determining flood areas are presented which apply to six important aspects of dam-break flood forecasting. These guidelines concern mode of failure, computation of the outflow discharge hydrograph produced by the breach, routing of the outflow hydrograph, determination of realistic initial and boundary conditions for dam-break flood-wave propagation, assumptions to be made in the case of domino-type failures, and data required by various methods. The Task Force has also sought to simplify the model ordinance to facilitate its adoption and enforcement. (Geiger-FRC)
W82-02585

6G. Ecologic Impact Of Water Development

INSTITUTIONAL BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN THE SOUTHEAST - VOL I - TECHNICAL REPORT, PART I - INSTITUTIONAL BARRIERS,
Tennessee Univ., Knoxville. Graduate School of Planning.
For primary bibliographic entry see Field 6E.
W82-02101

CHESAPEAKE BAY LOW FRESHWATER INFLOW STUDY,
Corps of Engineers, Baltimore, MD. Baltimore District.
A. E. Robinson, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 114-127, 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Consumptive use, *Estuarine environment, *Salinity, *Water circulation, Model studies, Hydraulic models, Simulation, Drought, *Chesapeake Bay, Freshwater inflow.

Chesapeake Bay is the largest estuary on the Atlantic coast of the U. S. and one of the more important estuaries in the world. It is nearly 200 miles long and varies in width from 3 miles to 30 miles. Like all estuaries, it depends upon the inflow of freshwater to maintain its salinity regime. Salinity variations, spatial and temporal, constitute the most significant physical parameter influencing the circulation dynamics of the estuary and the types of aquatic species which reside in it. The quantity of fresh water flowing into the Chesapeake may be substantially reduced in the future due to a marked increase in the consumptive use of water. The Corps of Engineers Low Freshwater Inflow Study was conceived as a result of the concern over this increased consumptive use. The objectives of this study are to assess the environmental, economic, and social consequences of these reduced flows and if appropriate, to formulate criteria for minimum freshwater inflows. A major portion of this work will be based on the results of a series of tests conducted on the Chesapeake Bay Model. A drought or depressed freshwater inflows can be simulated at any time on the model. It will be necessary to conduct a series of three tests on the hydraulic model: a problem identification test, a sensitivity test, and a plan formulation test. (Moore-SRC)
W82-02114

ASPECTS OF IMPACTS ASSESSMENT OF LOW FRESHWATER INFLOWS TO CHESAPEAKE BAY,
Western Ecosystems Technology, Laurel, MD.
G. B. Shea, G. B. Mackiernan, L. C. Athanas, and D. F. Bleil.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 128-148, 14 Fig, 8 Ref.

Descriptors: *Estuarine environment, *Low flow, *Environmental effects, *Salinity, Model studies, Computer models, Simulation, Consumptive use, Drought, Ecosystems, Habitats, Water circulation, *Chesapeake Bay, Freshwater inflow.

Modification of the Chesapeake Bay hydrologic environment has occurred over the past several decades, and is expected to continue at least until the end of the century. An attempt to assess the impact of low freshwater inflows (due to drought and consumptive losses) upon the Chesapeake Bay biota is currently underway. Some of the tools being used in this assessment are: distribution, tolerance, and life history studies of selected estuarine species; hydraulic modeling of salinity and circulation regimes; and computer simulation of representative segments of the ecosystem. Critical life history stages, habitat and food requirements, and tolerance to physical stress have been used to select representative study speces for evaluation of effects of reduced freshwater flows. Information on community structure and trophic relationships has been used to develop a conceptual model of major energy flows within the Chesapeake Bay ecosystem. A computer simulation model will be used to provide insight into the effects of low flow, and the propagation of these effects throughout the ecosystem. The results of this study will aid managers in planning consumptive use patterns of freshwater flows into the estuary. (Moore-SRC)
W82-02115

FRESHWATER INFLUENCES ON STRIPED BASS POPULATION DYNAMICS,

Maryland University, Solomons. Chesapeake Biological Lab.
J. A. Mihursky, W. R. Boynton, E. M. Setzler-Hamilton, K. V. Wood, and T. T. Polgar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, October, 1981. p 149-167, 5 Fig, 3 Tab, 45 Ref.

Descriptors: *Estuaries, *Environmental effects, *Bass, *Growth stages, Water resources development, Water quality, Hydrodynamics, Larval growth stages, River flow, Seasonal variation, Runoff, Climates, *Potomac River estuary.

In order to provide projected freshwater supplies for human activities in the Washington, D.C., metropolitan area a number of engineering devices have been proposed, including a number which have the potential to change hydraulic regimes in the Potomac River. A population dynamics study of striped bass was conducted in the Potomac Estuary from 1974-1977 to determine the effects of these changes. Investigations included measurement of hydrodynamic characteristics; water quality; phytoplankton; zooplankton; and striped bass egg, larval, juvenile, and adult stages. Larval and juvenile food habit data were also developed. Biological data indicated that striped bass year-class success, as measured by juvenile abundance, was not closely correlated to abundance of spawning stock, number of eggs deposited or early, non-feeding larval stages. These results suggested that density-independent mechanisms controlled the eratic patterns of year-class success of the this species. Climatic data were compared to available juvenile abundance data for a 25-year period. Strong year-classes were correlated with colder than average winters (December) which were followed by above average spring (April) freshwater runoff to the estuary. High densities of zooplankton at the time of first larval feeding and the spatial distribution of the spawning stock contributed to larval survivorship and consequent establishment of year-class strength. Evidence suggests that any significant diminution of springtime freshwater discharge to the estuary would tend to decrease the probability of substantial recruitment success. (Moore-SRC)
W82-02116

THE EFFECTS OF FRESHWATER DISCHARGES ON SPORTFISHING CATCH RATES IN THE ST. LUCIE ESTUARY, MARTIN COUNTY, FLORIDA,
Fish and Wildlife Service, Vero Beach, FL. Ecological Services.
E. Van Os, J. D. Carroll, Jr., and J. Dunn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980, Fish and Wildlife Service, Office of Biological Services Rept FWS/OBS-81/04, Vol I, Oct. 1981. p 269-281, 1 Fig, 4 Tab, 6 Ref.

Descriptors: *Sport fishing, *Flow dishcarge, *Fish behavior, *Estuarine fisheries, Flood control, Environmental effects, *St Lucie estuary, Martin County, Florida.

The St. Lucie River is a 6,000 acre estuary located on the east coast of Florida. It is the eastern outlet of fresh water released from Lake Okeechobee through the St. Lucie Canal. The primary purpose of the releases is for flood control. Neighboring communities depend heavily on tourism and are concerned about the effect that the freshwater discharges and associated silt loads have on fishing success. A creel census was conducted for one year. Multiple-source, stepwise regression analysis and ridge regression analyses were performed on the freshwater discharges and creel data to determine if catch rates are affected by the St. Lucie Canal discharges, and if so, in what part of the estuary they are affected. The catch rates of nine important fish species were found to be significantly influenced by the moderate freshwater discharges from the canal. The nine species were snook, croaker, sheepshead, mullet, black drum, weakfish, gafftopsail catfish, gray snapper, and Irish pompano. The discharges from the St. Lucie Canal over the survey period amounted to 440,000 acre-feet. During discharges, species habits are less predictable, and the augmented freshwater releases cause fish movements. Long-term analyses show an actual drop in angler usage of the estuary in the face of great increases in human populations. (Moore-SRC)
W82-02124

FRESHWATER INTRODUCTION INTO LOUISIANA COASTAL AREAS,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 4A.
W82-02127

EFFECTS OF WETLAND CHANGES ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
For primary bibliographic entry see Field 4C.
W82-02129

TEXAS SHRIMP FISHERIES AND FRESHWATER INFLOW,
Texas Shrimp Association, Austin.
R. Rayburn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, September 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol I, October 1981, p 431-435. 10 Ref.

Descriptors: *Shrimp, *Estuarine fisheries, *Salinity, *Water management, River flow, Sediment transport, Nutrient, Commercial fisheries, Estuarine environment, Environmental effects, *Texas.

The economic impact of the shrimp industry to Texas was approximately one-half billion dollars in 1979. There are three species of shrimp which basically support the commercial shrimp fishery: the brown shrimp, the white shrimp, and the pink shrimp. The annual catches of these dominant species tend often to be highly variable, associated to a great degree with environmental conditions. Freshwater inflows and the resulting marsh area vitality are important to the shrimp, particularly during their critical estuarine-growth phase. During the estuarine growth phase, local fluctuations in temperature and salinity can drastically affect both the availability of marsh suitable for growth and the actual growth rate of the shrimp. Man-made alterations such as impoundments, bulkheading and alterations in freshwater discharges can accentuate the fluctuations causing considerably more detrimental impact. While ever-increasing requirements are being placed on the surface water resources, the need for balanced salinity regimes as well as sufficient nutrients and sediments to maintain a sound habitat should be paramount in the allocation process. Water management agencies, fishery resource protection agencies, and the fishing industry should maintain a close working relationship to insure vitality of the estuaries and the significant fisheries resource. (Moore-SRC)
W82-02131

AN EVALUATION OF AQUATIC LIFE FOUND AT HYDRAULIC SCOUR SITES IN THE COLUMBIA RIVER ESTUARY SELECTED FOR POTENTIAL SEDIMENT DEPOSITION,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 2L.
W82-02132

THE EFFECTS OF FRESHWATER INFLOW ON SALINITY AND ZOOPLANKTON POPULATIONS AT FOUR STATIONS IN THE NUECES-CORPUS CHRISTI AND COPANO-ARANSAS BAY SYSTEMS, TEXAS FROM OCTOBER 1972-MAY 1975,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
R. D. Kalke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131426, Price Codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., September 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol I, October 1981, p 454-471. 9 Fig, 1 Tab, 18 Ref.

Descriptors: *Salinity, *Estuarine environment, *Zooplankton, *Rainfall, *Streamflow, Water use, Flushing, Nutrients, Foods, Predation, Copepods, *Texas, Bays, Freshwater inflow.

Increased municipal, agricultural, and industrial usage of fresh water prompted the need for research in determining requirements for freshwater inflow into Texas estuaries. Between October 1972 and May 1975, two periods of major freshwater inflow (June-November 1973 and August-September 1974) affected zooplankton populations in the Nueces-Corpus Christi and Copano-Aransas Bay Systems. Salinity fluctuations in the study area were negatively correlated with local rainfall. Stronger negative correlations were observed for salinity with streamflow. Major freshwater incursions physically flush out estuarine zooplankton populations and replace them with freshwater species. Increased salinities even as low as 1.0 ppt to 3.0 ppt result in a rapid return of estuarine species, especially the euryhaline copepod Acartia tonsa. It is speculated that the success of large populations of A. tonsa following peak inflows can probably be attributed to influx of nutrients, food, and a decrease in higher salinity predators. The higher overall salinities recorded during this study in the Nueces-Corpus Christi Bay system indicate that this area is affected by tidal incursions of higher salinity Gulf water more than the Copano-Aransas Area. (Moore-SRC)
W82-02133

INFLUENCES OF FRESHWATER INFLOW ON CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA) IN THE SACRAMENTO-SAN JOAQUIN ESTUARY,
Fish and Wildlife Service, Stockton, CA.
M. A. Kjelson, P. F. Raquel, and F. W. Fisher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonia, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 88-108. 6 Fig, 23 Ref.

Descriptors: *Salmon, *Environmental effects, *Estuaries, *River flow, *Anadromous fish, Survival, Fish migration, Diversion losses, Flow pattern, Dissolved oxygen, Water temperature, Water resources development, Freshwater inflow, *Sacramento-San Joaquin estuary, California.

Changes in freshwater influence the survival, abundance, migration and rearing of chinook salmon in the delta portion of the estuary. Low flows in the upper Sacramento and San Joaquin Rivers result in decreases in fry migration to the estuary, and juvenile abundance and survival in the delta. Both adult and juvenile migration are adversely affected by diversions from the San Joaquin River. Young salmon are caught on the screens while smaller fish pass through, and additional fish are lost at unscreened diversions. Adult fish are prevented from using some channels for migration because of the flow reversals caused by pumping. Low flows in the rivers result in higher water temperatures which discourage adult salmon migration. Low dissolved oxygen levels caused by high levels of organic materials in the rivers also discourage adult migration. These observations are based on seine and trawl surveys, collections at water diversion fish screens, and mark-recapture techniques. Many of the present and potential flow-related

problems are largely attributed to water development operations upstream and within the estuary. Management plans have been designed to correct some of these problems. (Brambley-SRC)
W82-02142

SOME EFFECTS OF FRESH WATER ON THE ATCHAFALAYA BAY SYSTEM,
University of Southwestern Louisiana, Lafayette. Dept. of Botany.
H. D. Hoese.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 110-124. 3 Fig, 6 Tab, 7 Ref.

Descriptors: *Atchafalaya Bay, Louisiana, *Ecosystems, *Aquatic animals, *Environmental effects, *River flow, *Estuaries, Salinity, Water temperature, Productivity, Floods, Flood control, Freshwater inflow.

Diversion of water from the Mississippi River to the Atchafalaya River has caused reduced salinity in Atchafalaya Bay, becoming practically freshwater under flood conditions. Salinity ranged from 0.1 - 0.9 ppt over the year, while in Vermilion Bay, furthest from the river mouth the range was 0.2 - 9.3 ppt. There were significant differences in water temperature between the two bays with temperatures up to 5C warmer in Vermilion Bay. Significant variations occurred in air and water temperature differences between the two bays. The fauna of Atchafalaya Bay was characterized by river shrimp, gars and catfish, while that of Vermilion Bay was characterized by white shrimp, anchovies and bull sharks. Productivity decreases are suggested to be a result of the decreased temperature caused by increased flows of cold river water, particularly during the winter and spring floods. This effect of flood flows should be considered when flood management systems are designed. (Brambly-SRC)
W82-02143

FRESHWATER INFLOW AND SALT WATER BARRIERS FOR MANAGEMENT OF COASTAL WILDLIFE AND PLANTS IN LOUISIANA,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
R. H. Chabreck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in papercopy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 125-138. 3 Tab, 22 Ref.

Descriptors: *Coastal marshes, *Coastal zone management, *Saline water intrusion, *Saline water barriers, *Ecosystems, Channeling, Levees, Subsidence, Erosion, Salt marshes, Brackish water, Wetlands, Ducks, Muskrats, Alligators, Freshwater inflow, Louisiana.

The Louisiana coastal marsh is subdivided into four types: saline, brackish, intermediate, and fresh. They occur in bands generally paralleling the coastline and contain characteristic water salinity levels and plant and animal communities. The boundaries of the marsh types have changed as a result of human activities and natural events. The northern boundary of the salt marsh has moved inland an average of 3.4 km in the period 1943-1968, largely as a response to leveeing, canal dredging and stream channelization, and subsidence and erosion. The various characteristics of each marsh and its plant life provide for habitats for different animal species which use one or more preferentially. The saline marsh supports fewest plant species, and the fresh marsh the most. Dabbling ducks favor the intermediate and fresh marshes, muskrats prefer the saline and brackish marshes, and alligators prefer the brackish and intermediate marshes. Nutria populations tend to decrease as salinity increases. The tendency to increased salt marsh results in decreases in wildlife. Two methods are available to prevent the advance of salt-water: artificial barriers, and freshwater introduction into the headquarters of the drainage basin. Both methods have application in Louisiana, and a recommended goal is to restore the marshes to their conditions in 1943. (Brambley-SRC)
W82-02144

REVIEW OF ESTUARINE-RELATED PROJECTS BY THE GULF OF MEXICO FISHERY MANAGEMENT COUNCIL,
Gulf of Mexico Fishery Management Council, Tampa, FL.
V. J. Blomo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 147-154. 6 Ref. 2 Append.

Descriptors: *Estuarine environment, *Federal jurisdiction, *Gulf of Mexico, *Fisheries, *Fish management, *Shellfish, Estuaries, River flow, Channelization, Dredging, Spoil disposal, Wetlands, Land development, Planning, Permits.

The enactment of the Fishery Conservation and Management Act of 1976 provided for the stewardship, by regional fishery management councils, of the fishery resources beyond state jurisdiction to 200 miles. The councils develop management plans for fish and shellfish which consider fishery resources in their entire range of habitat. In the Gulf of Mexico, most of the fishery resources are estuarine-dependent, and the Gulf Council therefore has taken a keen interest in alterations to this habitat. Council input to projects affecting freshwater inflow to estuaries is proper because of its responsibility and effective because of the diverse interests represented on the council. Input made to date relates to diversion of freshwater; channelization, dredging and spoils disposal; residential development; and private use of a wetland area affecting public resources. In the one case which has been decided a permit for the development was denied. (Brambley-SRC)
W82-02146

VALUES OF ECOLOGICAL CHARACTERIZATION STUDIES TO ASSESS EFFECTS OF FRESHWATER INFLOW TO ESTUARIES,
Fish and Wildlife Service, Slidell, LA.
J. B. Johnston, N. G. Benson, and B. D. King, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 155-164. 2 Fig, 10 Ref.

Descriptors: *Ecosystems, *Coasts, *Estuaries, *Planning, *Coastal zone management, Environmental effects, River flow, Channelization, Reservoirs, Marshes, Chenier Plain, Mississippi Deltaic Plain, Wetlands, Erosion, Ecological effects, Freshwater inflow.

Ecological characterization studies compile existing information (utilizing a holistic approach) that identifies functional relationships among natural processes and components of coastal ecosystems. Some studies have mapped habitat changes from aerial photographs over a 20- to 25-year time period. The studies integrate environmental and socioeconomic information in a form useful for planning, impact assessment and analysis. Studies completed or underway include the Chenier Plain of Southwestern Louisiana and Southeastern Texas, Sea Islands Region of South Carolina and Georgia, Pacific Northwest, Northern and Central California, Mississippi Deltaic Plain, Texas Barrier Islands Region, Rocky Coast of Maine, Northeastern Gulf of Mexico, and Southwestern Florida. Data from the Sabine basin of the Chenier Plain study demonstrated the quantified effects of modifying natural river flow on Sabine Lake and the associated estuarine area. Navigation channel developments, construction of reservoirs on the incoming rivers, and impoundment of marshes were the primary causes of ecological changes. The Mississippi Deltaic Plain study mapped habitat changes from the mid-1950's to 1978. Many of the habitat changes resulted from the modification of freshwater inflow. The study indicated that over 500,000 acres (202,000 ha) of Louisiana coastal wetlands were lost or altered during the period. The information developed from the ecological characterizations will enable planners to understand and predict the consequences of future alterations in the coastal zone.
W82-02147

EFFECTS OF ALTERATIONS OF FRESHWATER INFLOWS INTO MATAGORDA BAY, TEXAS,
Texas Univ. at Austin. Dept. of Civil Engineering.
N. E. Armstrong, and G. H. Ward, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX, Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Rept. FWS/OBS-81/04, Vol II, Oct. 1981, p 179-196. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Matagorda Bay, *Texas, *Environmental effects, *Water resources development, *Seawater, *Diversion channels, Estuarine environment, Water demand, Salinity, Model studies, Nutrients, Habitats, Navigation, Sedimentation, Water circulation, Freshwater inflow.

The Matagorda Bay, Texas, region is experiencing increased development on its periphery and in its drainage basin. The Matagorda Bay Project is a three-year study focusing primarily on the effects of altered freshwater inflows on the living resources of the bay. Freshwater inflows will be reduced because of increased withdrawls of water from the Colorado, Lavaca, and Navidad Rivers for agricultural, industrial, and municipal purposes. The reduced inflows will cause an increase in salinity, but model studies show that this will be less than 1 ppt. Nutrient concentrations may be increased or reduced depending on upstream practices. The biological effects are expected to be the result of loss of nursery areas in secondary and tertiary bays, and the possible loss of nutrients. A navigation and diversion project is planned for the Colorado River, in which water from the river will be diverted into Matagorda Bay, and a navigation channel will be maintained to the Gulf of Mexico. The major effect of the diversion channel will be to alter the circulation in Matagorda Bay and increase sedimentation. The increased sedimentation will eliminate some shallow bay habitat, but at the same time, build up new marsh habitat. These results are preliminary; biological and hydrological studies are continuing. (Brambley-SRC)
W82-02149

OVERVIEW OF FRESHWATER INFLOW DEPLETIONS,
Fish and Wildlife Service, Fort Collins, CO.
For primary bibliographic entry see Field 6D.
W82-02152

THE RIVER CONTINUUM: A THEORETICAL CONSTRUCT FOR ANALYSIS OF RIVER ECOSYSTEMS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
R. L. Vannote.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 289-304. 5 Fig, 31 Ref.

Descriptors: *Rivers, *Ecosystems, *Environmental effects, Headwaters, Estuaries, Stream profiles,

Particulates, Suspended solids, Habitats, Light quality.

The river continuum concept suggests that a natural river system, from headwaters to estuary, can be considered a gradient of process zones ranging from a strongly detrital based system in headwater streams to a seasonal, or perhaps annual, autotrophic regime in moderate-sized streams and then, a gradual return to predominately heterotropic processes in large river systems. The structural and functional properties of stream communities tend to be selected to conform to the dynamic pattens of physical energy expenditure and the most probable physical state as proposed by fluvial geomophologists. Each stream reach along the continuum has local inputs in the form of light energy and particulate material from the terrestrial landscape and the partially processed materials transported from upstream reaches. Particle size of organic material in transport becomes progressively smaller as it passes down the continuum and biotic communities structured on the transport system become progressively more efficient in processing smaller particles towards downstream areas. Consumer communites in rivers are considered to be structured by local inputs, autochthonous and allochthous; materials in the transport system; and gradients in fluvial geomorphic processes throughout the drainage network. The concept may be used to predict changes resulting from upstream perturbations such as channelization, impoundments, logging, and waste inputs and in the management of rivers. (Brambley-SRC)
W82-02157

CHARACTERIZATION OF FRESHWATER INFLOW MODIFICATION TO ESTUARIES RESULTING FROM RIVER BASIN DEVELOPMENT,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
M. E. Jennings.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 375-384. 6 Fig, 9 Ref.

Descriptors: *River flow, *Estuaries, *Model studies, *Water resources development, Statistical analysis, Climatology, Simulation, Hydroelectric power, Reservoir operation, Freshwater inflow, *Ecological effects.

There are three approaches for determining quantity and modification of freshwater inflow to estuaries: continental-scale assessment, statistical studies of long-term records at the mouth of a river, and river basin modeling. Continental-scale assessments are of limited use in determining modifications of freshwater flows. The statistical approach is illustrated using long-term streamflow records for the Brazos River, Texas, and the Santee River, South Carolina. For both rivers, the influence of upstream impoundments is obvious, and for the Brazos River, the 9-year moving averages show the dominance of the long-term regional climatic effect on the flow pattern. River basin modeling, illustrated using data from the lower Santee River Basin, is believed to be the best approach for general field studies. The Large River Basin Transport Model is being developed, which will make long-term (20-50yr) simulations. The model was used with the Santee River data to optimize power production through a study of reservoir operating rules. The observed and computed flows were in good agreement for flow in the river and discharges used in power production. (Brambley-SRC)
W82-02162

DRAFT ENVIRONMENTAL ASSESSMENT DESALTING DEMONSTRATION PLANT, LAGUNA, NEW MEXICO.
MetaMetrics Inc., Washington, DC.
For primary bibliographic entry see Field 3A.
W82-02171

EFFECTS OF LAKE MICHIGAN DIVERSION ON THE WATER CHEMISTRY OF THE ILLINOIS WATERWAY,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Water Resources Bulletin, Vol 17, No 4, p 607-613, August, 1981. 3 Fig, 6 Tab, 4 Ref.

Descriptors: *Diversion, *Illinois waterway, *Environmental effects, Mathematical models, Mathematical studies, *Water quality, Chemical composition, *Lake Michigan.

Baseline water chemistry data were developed for the Illinois Waterway to assess the probable extent and magnitude of the impact of diverted Lake Michigan waters on the water chemistry of the Illinois Waterway. Two hundred and seventy miles of the Illinois Waterway were monitored at 10 mile intervals, and a statistical method was used to define the interstation relationships for the chemical parameters. Mathematical models were used to predict the effects of the Lake Michigan diversion. Two diversion schemes, increased diversions of 3400 cfs or 6800 cfs under three different flow conditions, were examined. The diversion of Lake Michigan water was predicted to improve the chemical quality of the waterway. The mineral content of the mixed flow resulting from increased diversion under average, wet, and dry flow conditions would not affect the osmotic balance of the waterway's fauna and flora. (Small-FRC)
W82-02261

USER REACTION TO WILD AND SCENIC RIVER DESIGNATION,
Clemson Univ., SC. Coll. of Forest and Recreation Resources.
R. H. Becker.
Water Resources Bulletin, Vol 17, No 4, p 623-626, August, 1981. 4 Tab, 10 Ref.

Descriptors: *Recreation demand, *Wild rivers, *Environmental protection, Recreation, Wilderness areas, Legal aspects.

Problems have arisen when new users are attracted to rivers which have been designated as wild and scenic, as the recreational behavior of the new users may be unacceptable. The designation as wild and scenic under the National Wild and Scenic Rivers Act of 1968 may actually attract more users and negatively affect the area the designation was designed to protect. Studies of use patterns on the northwest Wisconsin River and the Lower St. Croix/Mississippi indicated that increased use was associated with publicity and exposure to the general public. The national program reduces structural development, but there is a loss of low density recreational opportunities on the rivers. Legislation designating a specific river to the Wild and Scenic River System should include actions to preserve the social quality and recreational experiences that make the river special. (Small-FRC)
W82-02278

ENVIRONMENTAL REPERCUSSIONS OF IRRIGATION DEVELOPMENT IN HOT CLIMATES,
Ahmadu-Bello Univ., Zaria (Nigeria). Dept. of Environmental Health.
B. Z. Diamant.
Environmental Conservation, Vol 7, No 1, p 53-58, Spring, 1980. 2 Fig, 14 Ref.

Descriptors: *Irrigation programs, *Environmental effects, *Developing countries, Irrigation effects, Water resources development, Public health, Sprinkler irrigation, Diseases, *Human diseases, Social aspects, Economic aspects, Reservoirs, Vegetation effects, Water level fluctuation, Legislation.

Irrigation projects intended to improve food supplies and the quality of life in third world countries have caused severe problems: spread of waterborne diseases and social upheavals among the peoples resettled by flooding impoundments. Malaria and/or schistosomiasis have appeared or increased in the areas near Lake Akosombo, Ghana; Lake Nasser, Egypt; the Indus River Basin, Pakistan; and Helmand River project, Afghanistan. Environmental health aspects should be included in the planning, construction, and operation of large-scale irrigation projects. Vector control measures, which break the three-part cycle (sick carrier, transmitting vector, and recipient), can be accomplished by proper engineering to produce a habitat unfit for snails and mosquitos. Chemical, biological, and genetic control are not as effective or are still in the research stage. Some suggestions for destroying habitats for disease vectors are: controlling vegetation, straightening banks, producing frequent changes in water levels, reducing evaporation, eliminating wastewater influx, installing snail screens, using closed channels, sprinkling irrigation water, and choosing crops which do not need flooding. The complicated social and economic changes produced by these projects require a prior sociological survey. The population should be consulted before the fact on allocation of new farming plots, methods of cultivation, types of crops, and housing. Operation and maintenance of the water projects should be regularly surveyed by teams of ecologists, environmental engineers, entomologists, and health workers. (Cassar-FRC)
W82-02366

AN INDUSTRIAL VIEW. TREATMENT VIS-A-VIS DISCHARGE TO SEWERS,
Confederation of British Industry, London (England).
A. I. Biggs.
Water Science and Technology, Vol 13, No 7, p 331-335, 1981.

Descriptors: *Policy making, *Future planning, *Industrial development, *Ecological effects, Water resources development, Water use, Nonconsumptive use, Administrative decisions, Water quality management, Economic effects, Environmental effects, *United Kingdom.

The effect of industry and commerce on the environment is considered, with special focus on the use and protection of water resources and the economic aspects thereof. In the United Kingdom, commerce and industry account for most of the major discharges of used water into the rivers and estuaries. The Confederation of British Industry (CBI) has issued a policy statement asking governments to consider the benefits of industrial development when planning laws concerning the protection or use of natural waters. CBI has also urged industry to consult with government policymakers when planning for increased development. CBI maintains that well managed industrial and commercial growth should be compatible with careful use of environmental resources. (Geiger-FRC)
W82-02407

SOME ENVIRONMENTAL IMPACTS OF A STORM SURGE BARRIER,
Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam.
J. H. B. W. Elgershuizen.
Marine Pollution Bulletin, vol 12, No 8, p 265-271, August, 1981. 5 Fig, 1 Tab, 17 Ref.

Descriptors: *Flood control, *Barriers, *Environmental effects, Netherlands, *Holland, Storm surges, Estuaries, Scheldt Estuary, Salt marshes, Ecosystems, *Baseline studies.

In 1985 the newly designed storm surge barrier (SSB) will be constructed across the mouth of the eastern Scheldt in the Netherlands to seal off most of the large inlets in the southwestern part of the land. The project was launched in answer to drastic flood losses in 1953. A complete closure of most of the inlets and also the Eastern Scheldt was envisaged, except for the New Waterway and the Western Scheldt, which are important to shipping. The original study had called for the construction of a dam, but this was changed in 1976 to the construction of a storm surge barrier to close the Eastern Scheldt estuary, and thus buy safety for the polders and preserve the ecological system of the Eastern Scheldt. The SSB will cause the for-

mation of a new, unnatural ecosystem. To make the appropriate decisions to manage this area in as natural a way as possible, a sound knowledge of the Eastern Scheldt ecology is urgently needed. From the evaluation studies this far conducted it appears that one closure per year for 12 hr would not have any significant effect, but if closure times are long or if frequent complete closures occur, problems may arise. Thus it is suggested that, in place of complete closures, partly closing the barrier may avoid a concentrated attack of flood waters on sand and mud flats, dikes and salt marshes. This may result in the maintenance of a reduced tide in the Eastern Scheldt, and appears to offer a good compromise between safety and ecology. (Baker-FRC)
W82-02417

THE RELATIVE INFLUENCE OF DAMS AND SECULAR CLIMATIC CHANGE ON DOWNSTREAM FLOODING, AUSTRALIA,
Macquarie Univ., North Ryde (Australia). School of Earth Sciences.
For primary bibliographic entry see Field 2E.
W82-02425

RECENT TRENDS IN ENVIRONMENTAL IMPACT ASSESSMENT,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. M. Rosenberg, V. H. Resh, S. S. Balling, M. A. Barnby, and J. N. Collins.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 5, p 591-624, 1981. 5 Fig, 8 Tab, 225 Ref. (California Water Resources Center Project UCAL-WRC-W-519). OWRT-A-063-CAL(2).

Descriptors: *Environmental impact statement, *Assessments, *Aquatic environment, *Ecosystems, Powerplants, Fossil fuels, Recreation, Reservoirs, Wastewater treatment, Forestry, Dredging, Estuaries.

The overall objective of this paper is to examine the use that research based on the scientific method can have in assessing environmental impacts. Emphasis has been placed on environmental impacts that involve aquatic ecosystems. The specific objectives are to characterize an 'ideal' environmental impact assessment for several major types of developments, mainly in North America; and to identify successes, failures, and future needs in environmental impact assessment (e.i.a.). Environmental impact assessment has had the following successes; increased environmental awareness due to public involvement in e.i.a., some environmental protection, and elucidation of intruguing research problems. The list of failures of e.i.a. is, however longer: 'tokenism,' unrealistic time constraints, uncertainty of program or development schedules, difficult access to e.i.a. literature, questionable ethics, lack of coordination among studies, and poor research design.
W82-02525

RELATIONSHIP BETWEEN WATER QUALITY AND THE COMMUNITY STRUCTURE OF EPIPHYTIC DIATOMS IN A MISSISSIPPI BAYOU,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
M. J. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-157843, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Report, September, 1981. 27 p, 11 Tab, 14 Ref. OWRT-A-133-MISS(2), 14-34-0001-1126.

Descriptors: *Diatoms, Rooted aquatic plants, Sessile algae, Nitrogen compounds, Phosphorus compounds, *Water quality, *Bayous, Biological communities, Aquatic habitats, Marine algae, Rhodophyta, Chlorophyta, Cyanophyta, Submerged plants, Pondweeds, Salt marshes, *Mississippi, *Algae, Salinity, Comparison studies, Heavy rainfall effects, *Epiphytic algae, Grand Plains Bayou, Cocconeis, Bacillaria, Bostrychia.

Epiphytic diatoms were collected from the leaves of submerged angiosperms belonging to the genera Potamogeton, Zannichellia, and Najas in Grand Plains Bayou, Hancock County, Mississippi from March through September 1980. Extremely heavy rainfall caused this bayou to be an essentially freshwater system for the first five months of the study. Salinity finally rose to 6 o/oo in August and to 13 o/oo in September. The bayou waters were acidic to neutral for most of the study and concentrations of dissolved nitrogen and phosphorus were low, indicating that the system was relatively unproductive. Only seven species of red, blue-green, and green algae were collected and the epiphytic diatom flora was represented by a total of 50 taxa. The dominant diatom was Cocconeis placentula var. euglypta (Ehr.) Grun. which accounted for 84.1% of all valves counted. During the freshwater period species diversity (H') and the number of taxa in a sample (S) were very low, rarely exceeding 0.82 bits/individual and 10 taxa. After saltwater intrusion H' increased beyond 2.0 and S exceeded 20. Multiple regression involving H', S, or the relative abundances of seven taxa as the dependent variable and selected water quality measures as the independent variables demonstrated a significantly statistical relationship between Cocconeis fluviatilis Wallace and Bacillaria paradoxa Gmelin and water quality in Grand Plains Bayou. The abundance of the former could be predicted by knowledge of the concentrations of ammonia nitrogen, orthophosphate, and total dissolved phosphorus, while that of the latter could be predicted by salinity alone.
W82-02531

INTERACTIONS POTENTIALLY AFFECTING THE SEASONAL ABUNDANCE OF SELECTED AQUATIC INVERTEBRATES IN A RICE FIELD HABITAT,
Minnesota Univ., St. Paul.
F. G. Zalom.
Hydrobiologia, Vol 80, No 3, p 251-255, 1981. 3 Fig, 12 Ref.

Descriptors: *Population dynamics, *Invertebrates, *Predation, Rice, Seasonal variation, Water temperature, Vegetation effects, Midges, Crustaceans, Copepods, Species diversity, Corixidae, Belostomatidae, Dystiscidae, Hydrophilidae, Notonectidae, Aquatic animals, Paddies, Wetlands, California, *Rice farming.

The seasonal abundance of aquatic invertebrates in California rice fields depended on water temperature and plant stand. Predator-prey interactions further modified the observed seasonal patterns. Sampling was conducted weekly, May to August 1977 and 1978. Data was subjected to multiple regression analysis. Prey organisms were Chironomidae larvae, Corixidae, and Crustacea; predators were Belostomatidae, Dystiscidae adults, Hydrophilidae larvae, and Notonectidae. Prey populations peaked in mid to late June and to a lesser degree in late July. Predator populations displayed more variable peaks. Average water temperatures increased during the first 5 weeks after initial flooding of the rice paddies and decreased slightly as the plant stand grew denser in July. (Cassar-FRC)
W82-02568

7. RESOURCES DATA

7A. Network Design

MONITORING FRESHWATER INFLOW TO ESTUARIES BY REMOTE SENSING,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
R. W. Johnson, and B. M. Kendall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 17-40. 10 Fig, 3 Tab, 19 Ref.

Descriptors: *Remote sensing, *Satellite technology, *Estuaries, *River flow, Tidal rivers, Plumes, Temperature, Salinity, Suspended solids, Chlorophyll, Spatial distribution, Temporal distribution, Aerial photography, *Freshwater inflow.

Experiments conducted in the United States coastal zone indicate that features such as plumes from freshwater inflow have distinctive spectral characteristics. These spectral characteristics have been correlated with concentrations and/or distributions of temperature, salinity, suspended solids, and chlorophyll a in plumes and surrounding estuarine water. Remotely sensed wide area synoptic coverage of surface estuarine features provides a perspective on spatial and temporal distributions that is not readily available by shipboard measurements. Data outputs from remote sensors, to date, include high resolution measurements to determine concentrations and distributions of total suspended particulates, temperature, salinity, and chlorophyll a from airborne and/or satellite platforms; and low resolution measurements of total suspended solids, temperature, and possibly chlorophyll from satellite platforms. Archived data (such as from Landsat) may be used for historical studies of river plumes and other estuarine features. Examples are presented in which remotely sensed optical and microwave spectral range data, with and without concurrent surface measurements, are used to study spatial and temporal characteristics of plumes. In general, qualitative assessments may be made without concurrent surface measurements based on differences of water color, temperature, and salinity within the plume or between the plume and the receiving water. Quantitative distribution of suspended solids, temperature, salinity, and chlorophyll a require concurrent surface measurements to calibrate the remotely sensed data.
W82-02138

A DYNAMIC METHODOLOGY FOR CHARACTERIZING AND MONITORING ESTUARINE ECOSYSTEMS,
Gulf Universities Research Consortium, Houston, TX.
T. L. Linton, and S. G. Appan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-131434, Price codes: A23 in paper copy, A01 in microfiche. In: Proc. of the National Symposium on Freshwater Inflow to Estuaries, San Antonio, TX., Sep. 9-11, 1980. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/04, Vol II, Oct. 1981, p 448-462. 5 Fig, 12 Ref.

Descriptors: *Estuarine environment, *Estuaries, *Data acquisition, *Variability, *Prediction, Environmental effects, Monitoring, Water temperature, Salinity, Polychaetes, Species diversity, Substrates, Ecosystems.

A methodology is proposed that utilizes extant data from disparate sources for the purpose of determining or predicting transitory and/or permanent effects that natural and/or man-made changes will cause in an estuarine ecosystem. Data on estuaries in Alabama, Louisiana and Texas were used to construct a computer file, from which the natural variability of the estuary may be defined. Temperature and salinity changes were recorded for one year, and substrate type and polychaete species were determined for the following estuaries: Timbalier, Lavaca, Aransas, Copano, and Mobile. The Lavaca estuary characteristics were used to select monitoring stations, and the principal months for seasonal monitoring. The spatial, temporal, and species-level variability for polychaetes, and seasonal variability of temperature and salinity were determined. Data from the monitoring program that fall within these ranges would indicate that activities are not derimental to the estuary. This method provides a direct way to measure actual impacts, can be updated as more data becomes available, provides for prediction of impacts in similar estuaries, can aid in the design of monitoring programs, and detect the cumulative effects of many activities. (Brambley-SRC)
W82-02167

THE WARMWATER SPORT FISHERY OF EASTERN LAKE ONTARIO,

New York State Dept. of Environmental Conservation, Watertown.
F. M. Panek.
New York Fish and Game Journal, Vol 28, No 2, p 178-190, July, 1981. 4 Fig, 5 Tab, 11 Ref.

Descriptors: *Sport fishing, *Lakes, *Lake Ontario, Fish harvest, Surveys, Fish populations, Surveys, New York.

Findings of a creel census in New York waters of the eastern basin are reported. The study area comprised the waters of Lake Ontario from Stony Point to Tibbets Point. The census consisted of counting the number of anglers and interviewing some of them for specific information. It was conducted on 78 days between June 17 and October 27, 1978. Within the study area, 16 sampling stations were selected on the basis of their suitability for obtaining reliable counts of shore anglers and boat anglers. A total of 1,676 counts of shore anglers and boats were recorded, and 372 anglers were interviewed. Fishing pressure was estimated as 274,073 angler hours, with 91% of it being associated with boat fishery and 55% with the time spent on weekends and holidays. The estimated total fish harvest of 394,529 fish included 13 species, of which small mouth bass, yellow perch and rock bass comprised 98%. Catch rates for legal sized smallmouth bass averaged 0.47 fish per hour in the boat fishers. Catch rates were similar to those of earlier studies, indicating that the bass fishery in the eastern basin is both stable and of high quality. (Baker-FRC)
W82-02296

GROUND-WATER-LEVEL MONITORING NETWORK, HOLLISTER AND SAN JUAN VALLEYS, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. D. Farrar.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $4.25, Microfiche $4.00. Geological Survey Open-File Report 81-66 (WRI), March, 1981. 9 p, 1 Fig, 1 Plate, 1 Tab, 4 Ref.

Descriptors: *Groundwater, *Network design, *Wells, *Water level, *Monitoring, Sites, Well data, Artificial recharge, Geology, *California, San Benito County, San Juan Valley, Hollister Valley.

The addition of 17 wells to the existing 86-well network is proposed to improve the ground-water monitoring in the Hollister and San Juan Valleys in California. The new wells were selected on the basis of well-construction data, availability, location, accessibility, use, and condition, either to replace wells that are no longer accessible or to furnish needed additional data for planning artificial recharge, preparing water-level-contour maps, and digital ground-water modeling. (USGS)
W82-02487

REAL-TIME RAINFALL MONITORING-PREDICTION SYSTEM AND URBAN HYDROLOGIC OPERATIONS,
F. A. Huff, J. L. Vogel, and S. A. Changnon, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 419-435, October, 1981. 2 Fig, 10 Tab, 14 Ref.

Descriptors: *Urban hydrology, *Weather forecasting, *Storm water, *Chicago, Illinois, Meteorological data collection, Forecasting, Storm sewers, Rainfall distribution, Rain gages, Radar, Rainfall-runoff relationships, Remote sensing, Combined sewers, Monitoring, Water management.

A 4-year (1975-79) comprehensive hydrometeorological research program carried out in the Chicago metropolitan area was designed to expand the use of meteorological information in the real-time operation of urban hydrological systems to protect people, property, and the environment during moderate to heavy rains. A real-time monitoring-prediction rainfall system was developed. This monitors rainfall from storms crossing the urban area and predicts the rainfall distribution for the upcoming 30, 60, and 120 min. The system employs weather radar and a computer output when necessary. This man-machine combination produced more accurate rain monitoring data (accurate within 0.1 inch 76% of the time) than both unadjusted radar rainfall measurements (48%) and a dense network of recording rain gages (73%). With real-time rainfall data input from the Metropolitan Sanitary District network, predictions by the man-machine combination were accurate to within 0.1 inch 82% of the time. These improvements were most noticeable in heavier rainfall. (Cassar-FRC)
W82-02588

7B. Data Acquisition

AN INITIAL APPLICATION OF POLARIZATION LIDAR FOR OROGRAPHIC CLOUD SEEDING OPERATIONS,
Utah Univ., Salt Lake City. Dept. of Meteorology.
K. Sassen.
Journal of Applied Meteorology, Vol 19, No 3, p 298-304, March, 1980. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *Cloud seeding, *Remote sensing, Weather modification, Artificial precipitation, Lidar, Radar, Wasatch Mountains, *Utah.

Preliminary field application was made of polarization lidar in conjunction with commercial cloud seeding operations in the Wasatch Mountains of northern Utah. The lidar system transmits a vertically polarized lasar pulse and measures the returned energy in the planes of polarization both orthogonal and parallel to that of the source. Linear depolarization ratios are derived from the two-channel lidar data displays to characterize the change in the polarization state of the backscattered energy and provide an indication of cloud composition. The use of polarization lidar proved helpful in this study. Background observations of unseeded cloud layers could be obtained through the method to provide better knowledge of local orographic precipitation formation and to determine a measure of cloud ice water balance to aid in the establishment of generalized seeding criteria specific to a mountain barrier. The observed local dependence of cloud ice water balance on cloud top temperature shows support for the less than minus 30 degrees C cloud-top temperature seeding window. The ability to monitor cloud ice water balance can be applied to the real-time seed/no-seed decision. The combined use of radar and lidar data can remove some of the ambiguity in the interpretation of rawinsonde data for the derivation of seeding criteria. Direct observations of the modifications produced by seeding operations can be employed as part of a physical evaluation method to predict snowfall augmentation and targeting. Thus it was concluded that, despite the range limitations of lidar, the application of the remote sensing techniques can make important contributions to orographic cloud seeding operations and research. (Baker-FRC)
W82-02217

SOME MEASUREMENTS ON NEAR SURFACE TURBULENCE IN THE DEPTH DIRECTION AND SOME PHYTOPLANKTON DISTRIBUTION IMPLICATIONS,
Gore and Storrie Ltd., Toronto (Ontario).
M. D. Palmer.
Journal of Great Lakes Research, Vol 7, p 171-181, 1981. 11 Fig, 4 Tab, 26 Ref.

Descriptors: *Turbulent flow, *Phytoplankton, Aquatic plants, Plankton, *Harbors, Surface flow, *Hamilton Harbor, *Toronto Harbor, Diatoms, Surface water, Comparison studies.

Microphysical turbulence measurements taken near the water surface in Hamilton and Toronto harbors are presented along with some concurrent phytoplankton community structure data. The physical turbulence characteristics of the two harbors are compared. Also presented are some measurements of the depth turbulence at 0.5 and 3.0 meters below the water surface for a well stratified, partially stratified, and well-mixed water column in Hamilton Harbor. Concurrent with hot film measurements, horizontal velocity depth profiles were also measured periodically with drogues. Prevailing wind conditions, light attenuation, temperature, and biomass vs. depth were also measured. The light attenuation curves were used to provide data on the photic zone depth. The turbulence structure of the two harbors was different. The depth length scales were estimated to be 3.7 - 5.7 cm and 10.8 - 20 cm in the stratified and well-mixed cases, respectively. Depth dispersion coefficients were estimated to be 4.8 to 8.6 square centimeters per second and 22.7 to 44 square centimeters per second in the stratified and well mixed cases, respectively. In the well mixed case, depth phytoplankton patchiness did not occur. The mean depth patch size for green algae and Cryptomonads showed some relationship with turbulence integral scales and the most predominant periodicities. Greens were a larger portion of the biomass when the length and time scales were small, while diatoms were more prevalent with larger length and time scales. (Baker-FRC)
W82-02227

COMPOSITE SAMPLING OF HIGHWAY RUNOFF,
Brown and Caldwell, Seattle, WA.
D. L. Clark, R. Asplund, J. Ferguson, and B. W. Mar.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1067-1081, October, 1981. 10 Fig, 4 Tab, 12 Ref.

Descriptors: *Flow measurement, *Highways, Pollutant identification, Composite samples, Runoff, Storm water, Storm runoff, Field tests, Flow rates, Rainfall-runoff relationships, Water measurement, Sampling techniques.

A composite sampler has been developed to collect characteristic samples of storm water runoff from highways. It consists of a rectangular cross section open channel with a flow splitter placed parallel to the direction of flow. The device samples in proportion to the flow rate. The approach to the flow splitting dividers is at a supercritical slope, so that turbulent flow is maintained. This allows suspended solids to be sampled and prevents debris from clogging the flow splitter. The dimensions and materials of construction can be varied to fit the situation. In sampling a 1.22 acre area of Highway I-5 near Seattle, Washington, the equipment was designed to collect 1% of the total flow (about 50 cu ft for 1 incy of rainfall) with a 25 inch wide channel and an initial divider opening of 1 inch to collect 1/25 of the flow. Two additional flow splitting dividers produced the desired 1%. The composite sampling method has several advantages over the discrete sampling method. In addition to lower capital and operating costs and greater accuracy, it requires little attnetion and can be used at remote stations. It is checked only after a storm, when the depth of water is measured, a single sample collected, and a new plastic liner inserted. (Cassar-FRC)
W82-02230

AERIAL PHOTOGRAPHY TO DETECT RILL EROSION,
Washington State Univ., Pullman. Dept. of Agronomy and Soils.
B. E. Frazier, and D. K. McCool.
Transactions of the ASAE, Vol 24, No 5, p 1168-1171, 1176, September-October, 1981. 4 Fig, 5 Tab, 18 Ref.

Descriptors: *Erosion, *Remote sensing, Aerial photography, Photography, Infrared imagery, Farming, Rills, Rainfall, *Rill erosion, Palouse region, *Pacific Northwest.

The potential of low-level, large-scale aerial photography coupled with selective ground sampling to identify erosion in the Palouse region of the Pacific Northwest was investigated. A determination was also made as to which film (color or color-infrared) and viewing instruments were most

useful. The Palouse region includes large areas of silty loessial soils on roughly parallel hills with north and east facing slopes of 30 to 45% and south and west facing slopes of 0 to 30%. The climate is characterized by humid winters and dry summers. Most of the precipitation is received as low intensity rain or snow during the winter, when the soil is generally unprotected. Most water-caused erosion occurs between November and April. Implement patterns from chisel plowing, harrowing, double-disk drilling, and combining can be seen in the photographs with the naked eye. Furrow-spacing can be used as an indicator of surface roughness. Rills were the most common erosional features recognizable. These were documentable to various degrees, depending on the instrument used and the scale of photography. The contrast between dry soil and rill shadows was sufficient for easy detection of rills. There was little perceptible contrast in wet areas, making rills there hard to identify. Slope length and steepness can be measured with stereoscopic instruments, and crop management systems as well as some conservation practices may be identified. (Baker-FRC)
W82-02232

CONTINUOUS MONITORING AT MINWORTH WATER RECLAMATION WORKS,
Severn-Trent Water Authority (England).
X. M. V. Snaddon, J. Dee, F. Lax, M. Augustine, and H. Smith.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 77-92, January, 1980. 7 Fig.

Descriptors: *Monitoring, *Reclaimed water, *Sludge, *Water treatment, *Sewage effluent, *Biodegradation, Activated sludge, Construction materials, Electronic equipment, Biochemical oxygen demand, Organic carbon, Filtration, Water sampling, Calibration, Technology.

Minworth is a large water reclamation works which was used as a test site in an evaluation of the worth of continuous effluent monitoring. Long-term reliability of the monitoring system is limited by the finite life of both the pH and ammonia probes. Information to date indicates that the probes work satisfactorily for at least one month. The life of each probe is determined by the quality of effluent being examined. The system can run satisfactorily for a minimum of a week at a time. It has been in operation for over one year. Data obtained is conveyed to the central control room by a private wire telemetry system. The overall costs and benefits of this test project have not yet been calculated. (Titus-FRC)
W82-02431

A MORE VERSATILE SOIL WATER SAMPLER,
North Central Forest Experiment Station, Grand Rapids, MN.
M. D. Knighton, and D. E. Streblow.
Soil Science Society of America Journal, Vol 45, No 1, p 158-159, January-February, 1981. 1 Fig, 3 Ref.

Descriptors: *Soil water, *Instrumentation, *Sampling, Nutrients, Water quality, Leaching, *Ceramic cup, *Porous cup, Soil solution, Nutrient cycling, Nutrient budget.

The design and fabrication of a new versatile ceramic-cup soil water sampler are described. The new sampler may be installed prior to disruptive plot treatments that would destroy earlier models. The new sampler prevents the reverse flow of collected soil water that otherwise occurs if the soil dries during the sampling interval. In addition, the ceramic cup may be positioned very near the soil surface without the problems of instability that occur with earlier models.
W82-02523

STREAM SYSTEM EVALUATION WITH EMPHASIS ON SPAWNING HABITAT FOR SALMONIDS,
Corvallis Environmental Research Lab., OR.
M. A. Shirazi, and W. K. Seim.
Water Resources Research, Vol 17, No 3, p 592-594, June, 1981. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Spawning, *Fish eggs, *Streambeds, Aquatic habitats, Gravel, Salmon, Trout, Sediments, Ecological effects, Sediment grading, Land use.

A procedure for evaluating sedimentation impact on streambed gravel used for spawning by salmonids is presented. A visual estimation of the gravel composition, considering the requirements of the particular species, helps reduce the number of samples needed. A graph relates the mean diameter of the substrate to the estimated embryo survival. As an illustration, two Orgon creeks were studied: 2 km of Canal Creek (impacted by logging) and 1 km of Rock Creek (in an undisturbed area). The visual survey took two hours per km. Two persons worked an additional four hours each in sampling and field analysis of gravel at each site. Results indicated that 50% of Canal Creek and 20% of Rock Creek were suitable for spawning. Total spawning areas that would support greater than 80% survival are 860 sq m per km for Rock Creek and 160 sq m per km for Canal Creek. (Cassar-FRC)
W82-02552

COMPARISON OF AREAL SNOW STORAGE SAMPLING PROCEDURES FOR RANGELAND WATERSHEDS,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2C.
W82-02555

THE EFFECT OF CURRENT ON THE DISTRIBUTION OF DIATOMS SETTLING ON SUBMERGED GLASS SLIDES,
N. Munteanu, and E. J. Maly.
Hydrobiologia, Vol 78, No 3, p 273-282, 1981. 4 Fig, 5 Tab, 28 Ref.

Descriptors: *Water currents, *Diatoms, *Distribution patterns, Streams, Algae, Lennoxville, Quebec, Periphyton, Substrates.

Glass slides oriented parallel and perpendicular to the current in a small stream near Lennoxville, Quebec, were submerged for 2-6 weeks to observed diatom growth patterns. Cocconeis placentula, Achnanthes linearis, and A. minutissima were the most abundant of the 98 species identified on the slides. Early colonization took place on the upstream and/or downstream edges of slides placed parallel to the current, followed by growth on the face of the slides. The slides placed perpendicular to the current showed even, random growth of algae. Slides at rocky sites contained more cells at the top edge than slides at muddy sites. The diatoms' preference for upstream and downstream edges on parallel slides is ascribed to current, which probably induces a higher invasion rate and higher reproduction rate. Diagrams illustrate how the slide edges are exposed to microturbulent flow and the increased possibility of algae collision with such a surface compared with the slide surface where laminar flow is present. Light has no apparent effect on spatial preference of diatoms in lotic environments. (Cassar-FRC)
W82-02567

REAL-TIME RAINFALL MONITORING-PREDICTION SYSTEM AND URBAN HYDROLOGIC OPERATIONS,
For primary bibliographic entry see Field 7A.
W82-02588

7C. Evaluation, Processing and Publication

AUTOMATIC CAPTURE AND PROCESSING OF ANALYTICAL DATA IN A WATER INDUSTRY LABORATORY,
Severn-Trent Water Authority, Birmingham (England).
P. J. Morley, P. R. Musty, and J. Cope.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 3, p 256-264, May, 1980. 4 Fig, 4 Tab.

Descriptors: *Water analysis, *Data processing, *Computers, Automation, Pollutant identification, Water quality, Data acquisition.

The Wang 2200C Basic programmable calculator is the basis of an automatic analytical data handling system chosen by the Severn-Trent Water authority laboratory in 1975. The parameters determined by Auto Analyzer are anionic detergent, soluble phosphate, total phosphate, ammonia-N, total N, total oxidized N, nitrate-N, and COD. Other parameters are measured and input manually. The system compares well with manual data evaluation methods in accuracy, giving a mean difference of less than 0.1 at the average concentration of 6.9 mg per liter. A sample reception system was developed to provide a test tracking system and to permit printout of results and management statistics. Use of the computer saves 7 man-hours per work day and reduces human error. (Cassar-FRC)
W82-02207

CURRENT WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN NORTH DAKOTA--FISCAL YEAR 1981.
Geological Survey, Bismarck, ND. Water Resources Div.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $7.00, Microfiche $3.50. Geological Survey Open-File Report 81-923, July, 1981. 50 p, 4 Fig. (Compiled by Martin, C. R., and Albright, L. L.).

Descriptors: *Data collections, *Groundwater, *Water quality, *Surface water, Streamflow, Runoff, Streams, Networks, Aquifers, Regional analysis, Energy, Snow surveys, *North Dakota.

Water-resources studies and investigations in North Dakota made by the U.S. Geological Survey in cooperation with State and Federal agencies are summarized. The investigations include data-collection projects, county groundwater studies, regional water-resource studies, aquifer evaluations, energy-related water-resource studies, and special investigations. The special investigations include snow survey research, groundwater quality sampling technique research and hydrologic response changes on a major stream. (USGS)
W82-02463

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1981,
Geological Survey, Tampa, FL. Water Resources Div.
D. K. Yobbi, W. M. Woodham, and G. R. Schiner.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $1.75, Microfiche $0.50. Geological Survey Open-File Report 81-1006, 1981. 1 Sheet.

Descriptors: *Potentiometric level, *Groundwater, *Maps, Aquifers, Water table, Wells, Water level fluctuations, Pumping, Irrigation, *Florida, Southwest Florida Water Management.

A May 1981 potentiometric-surface map of the Southwest Florida Water Management District depicts the annual low water-level period. Potentiometric levels decreased 10 to 45 feet between September 1980 and May 1981 in the citrus and farming sections of southern Hillsborough, northern Hardee, southwestern Polk, northwestern DeSoto, and Manatee Counties. Water levels in these areas are widely affected by pumping for irrigation and have the greatest range in fluctuations. Water-level decreases ranged from 0 to 1 feet in coastal, northern, and southern areas of the Water Management District. Water levels in all of the approximate 700 wells measured in May 1981 are lower than May 1980 because of the virtual absence of rainfall in April and May. (USGS)
W82-02464

WATER-RESOURCES INFORMATION FOR THE WITHLACOOCHEE RIVER REGION, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6B.
W82-02473

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1979.
Geological Survey, Salt Lake City, UT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-158981, Price codes: A99 in paper copy ($42.00), A01 in microfiche. Geological Survey Water-Data Report UT-79-1, 1980. 604 p, 7 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Utah.

Water resources data for the 1979 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 276 gaging stations; stage and contents for 21 lakes and reservoirs; water quality for 64 hydrologic stations, 183 partial-record stations, and 303 wells; and water levels for 36 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (USGS)
W82-02474

HYDROLOGIC MAPS OF OGALLALA AQUIFER, WEST-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
L. E. Dunlap, and J. M. Spinazola.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Prices: $18.00 in paper copy, $2.00 in microfiche. Geological Survey Open-File Report 81-098, 1981. 4 Sheets.

Descriptors: *Maps, *Groundwater, *Approximation method, *Mathematical analysis, Hydrologic data, Water distribution, *Groundwater management, Irrigation, Aquifers, Water table, Kriging, *Kansas, Ogallala aquifer, Western Kansas Groundwater Management District No 1.

A mathematical technique, called kriging, was programmed for a computer to interpolate hydrologic data based on a network of measured values in west-central Kansas. The computer program generated estimated values at the center of each 1-mile section in the Western Kansas Groundwater Management District No. 1 and facilitated contouring of selected values that are needed in the effective management of ground water for irrigation. The kriging technique produced objective and reproducible maps that illustrated hydrologic conditions in the Ogallala aquifer, the principal source of water in west-central Kansas. Maps of the aquifer, which use a 3-year average, included the 1978-80 water-table altitudes, which ranged from about 2,580 to 3,720 feet; the 1978-80 saturated thicknesses, which ranged from about 0 to 250 feet; and the percentage changes in saturated thickness from 1950 to 1978-80, which ranged from about a 50-percent increase to a 100-percent decrease. A map showing errors of estimate also was provided as a measure of reliability for the 1978-80 water-table altitudes. Errors of estimate ranged from 2 to 24 feet. (USGS)
W82-02475

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1981,
Geological Survey, Orlando, FL. Water Resources Div.
G. R. Schiner, and E. C. Hayes.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $3.50, Microfiche $0.50. Geological Survey Open-File Report 81-1052, 1981. 1 Sheet.

Descriptors: *Potentiometric level, *Groundwater, *Maps, *Aquifers, Water table, Wells, Water level fluctuations, Pumping, Geohydrology, *Florida, East-central Florida, St. Johns River Water Management District.

This map presents the potentiometric surface of the Floridan aquifer in the St. Johns River Water Management District and vicinity for May 1981. The Floridan aquifer is the principal source of potable water in the area. Water-level measurements were made in approximately 1,000 wells and at several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area 20 and 40-foot intervals are used to show a deep cone of depression. The potentiometric surface ranged from 122 feet above NGVD (National Geodetic Vertical Datum of 1929) in Polk County to 125 feet below NGVD in Nassau County. Water levels were at record lows in many counties due to lack of rainfall. Declines were as much as 10 feet and commonly 5 feet from the May 1980 levels. (USGS)
W82-02479

WATER RESOURCES OF THE KISATCHIE WELL-FIELD AREA NEAR ALEXANDRIA, LOUISIANA,
Geological Survey, Alexandria, LA. Water Resources Div.
J. E. Rogers.
Louisiana Department of Transportation and Development. Office of Public Works Water Resources Technical Report No 26, 1981. 57 p, 7 Fig, 6 Plates, 11 Tab, 35 Ref.

Descriptors: *Groundwater, *Permeability, *Transmissivity, *Specific capacity, *Water yield, Water quality, Surface-groundwater relations, Aquifer characteristics, Aquifer testing, Water level, Wells, Infiltration, Base flow, Evapotranspiration, Chemical analysis, Hydrologic data, *Louisiana, Alexandria, Rapides Parish, Kisatchie Forest.

Sands of Miocene, Pliocene, and Pleistocene age contain freshwater in central Rapides Parish, La. In this area the base of fresh ground water ranges from 900 feet to more than 2,500 feet below National Geodetic Vertical Datum of 1929. Hydraulic conductivity of the aquifers ranges from 20 to 200 feet per day, and storage coefficient ranges from 0.0001 to 0.2. Production of water from the Kisatchie well field has been as high as 25 million gallons per day for municipal and industrial uses. The 35 wells (90-2,078 feet deep) that produce the water have yields ranging from 190 to 1,100 gallons per minute. Specific capacities range from 1.3 to 46.5 gallons per minute per foot of drawdown. Water from these wells is soft and low in dissolved solids. The pH of water from the deeper wells is greater than 7; that of water from the shallow wells is lower than 7. Additional water can be produced from the aquifers in the project area or from Spring Creek and the Calcasieu River, which have high base flow sustained by outflow from the Pleistocene deposits. The streams are an alternate source rather than an additional source of water. (USGS)
W82-02480

ESTIMATED WATER USE IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. D. Duerr, and J. T. Trommer.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $8.25, Microfiche $3.50. Geological Survey Open-File Report 81-1060, 1981. 60 p, 26 Fig, 7 Tab, 17 Ref.

Descriptors: *Water use, *Data collections, *Water management, *Water demand, Groundwater, Surface water, Water supply, Municipal water, Industrial water, Irrigation water, Withdrawal, Saline water, *Florida, Southwest Florida Management District.

Water-use data for 1980 are summarized in this report for 16 counties in the Southwest Florida Water Management District. Data include total use of ground water and surface water for each of five water-use categories. The 1980 withdrawals for each category were as follows: 290 million gallons per day for public supply, 63 million gallons per day for rural, 325 million gallons per day for industry, 416 million gallons per day for irrigation, and 6,605 million gallons per day for thermoelectric power generation. Withdrawals totaled 7,699 million gallons per day and included 983 million gallons per day of ground water and 6,716 million gallons per day of surface water. Excluding thermoelectric power generation, all water withdrawn was freshwater except 38 million gallons per day of saline ground water withdrawn for industrial use in Hillsborough County. (USGS)
W82-02482

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI--FISCAL YEAR 1981.
Geological Survey, Rolla, MO. Water Resources Div.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $8.00, Microfiche $3.50. Geological Survey Open-File Report 81-683, August, 1981. 60 p, 2 Fig. (Compiled by Kratzer, W. M.).

Descriptors: *Water quality, *Surface water, *Groundwater, *Data collections, Sites, Publications, Bibliographies, Hydrologic data, Networks, Gaging stations, Crest gages, Low flow, Urban runoff, Reviews, *Missouri.

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretative investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1981 fiscal year and provides an extensive list of water-resources references for the State. (USGS)
W82-02488

WATER-QUALITY RECONNAISSANCE OF THE LARKIN CREEK WATERSHED, LEE AND ST. FRANCIS COUNTIES, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5A.
W82-02489

SELECTED HYDROGEOLOGIC DATA FROM THE JUDITH BASIN, CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. F. Levings, and K. A. Dodge.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $14.25, Microfiche $4.00. Geological Survey Open-File Report 81-1015, September, 1981. 98 p, 2 Fig, 1 Plate, 5 Tab, 6 Ref.

Descriptors: *Groundwater, *Water quality, *Data collections, *Geohydrology, Aquifers, Wells, Springs, Well logs, Water sampling, Chemical analysis, Sites, Maps, *Central Montana, Judith basin, Great Plains.

Selected hydrogeologic data from the Judith basin, central Montana, have been compiled for use as the physical basis of a ground-water model prepared as part of a 4-year study of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of 1,124 wells and 640 springs are tabulated in the report; most of these data have been collected since 1959. Lithologic logs of 68 wells are also included. Chemical data for wells and

springs include 290 water samples analyzed for major cation and anion concentrations and 282 water samples analyzed for miscellaneous-constituent concentrations. The locations of wells and springs listed in the report are shown on a map at a scale of 1:250,000. (USGS)
W82-02490

ALTITUDE OF THE WATER TABLE IN THE ALLUVIAL AND OTHER SHALLOW AQUIFERS ALONG THE COLORADO RIVER NEAR LA GRANGE, TEXAS, DECEMBER 1980,
Geological Survey, Austin, TX. Water Resources Div.
P. Rettman.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Prices: $1.00 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 81-1063, September, 1981. 1 Sheet, 1 Ref.

Descriptors: *Water table, *Maps, *Aquifers, Contours, Water level, Springs, Wells, Water yield, Groundwater movement, *Texas, La Grange, Colorado River.

The water-table contours on this map were constructed from water-level control derived from an inventory of springs and wells in the area, U.S. Geological Survey topographic maps, and from data presented by Rogers (1967). Because of the available water-level control and the rough terrain throughout the area, the delineation of the water table was limited to 20-foot contour intervals. On the basis of recent river-stage and precipitation records, this delineation should represent near or slightly below average conditions. In addition to the alluvium, several other geologic formations crop out in the areas. These formations are capable of producing small to large quantities of water to wells, but the current (1981) pumping demand is small. The pressure heads in each of these formations appear to be in continuity, and the contours indicate that no barriers restrict ground-water movement from one formation to another. Several water-producing horizons may be present at many locations. The water-table map was constructed by using the head in the horizon that is nearest the land surface. The configuration of the water table closely approximates the topography. The water table slopes from the highland areas toward the Colorado River and small creeks. The delineation of the water table in the alluvium of the Colorado River is fairly well defined, and 10-feet contour intervals may be interpreted with confidence in the area called 'potential lignite-mining area.' The water table in the bedrock aquifers is more difficult to delineate with the available data; therefore, the contours are only estimates of the position of the water table in the hilly bedrock area adjacent to the Colorado River alluvium. (USGS)
W82-02491

WATER RESOURCES DATA FOR INDIANA, WATER YEAR 1980.
Geological Survey, Indianapolis, IN. Water Resources Div.
Geological Survey Water-Data Report IN-80-1, June, 1981. 416 p, 4 Fig, 3 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collection, Sites, *Indiana.

Water resources data for the 1980 water year for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 185 gaging stations, stage and contents for 12 lakes and reservoirs, releases from 6 flood-control reservoirs, water quality for 51 gaging stations, and water levels for 79 observation wells. Also included are 97 crest-stage partial-record stations and 69 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Indiana. (USGS)
W82-02492

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1980--VOLUME 4. NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-136128, Price codes: $48.00 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-80-4, August, 1981. 697 p, 46 Fig, 1 Tab, 16 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Florida, *Northwest Florida.

Water resources data for the 1980 water year in Florida consists of continuous or daily discharge for 271 streams, periodic discharge for 47 streams, continuous or daily stage for 67 streams, periodic stage for 49 streams, peak discharge for 76 streams and peak stage for 23 streams; continuous or daily elevations for 75 lakes, periodic elevations for 128 lakes; continuous ground water levels for 483 wells, periodic ground water levels for 661 wells, and miscellaneous water level measurements for 2,807 wells; quality of water data for 301 surface water sites and 842 wells. The data for northwest Florida include continuous or daily discharge for 64 streams, periodic discharge for 18 streams, peak discharge for 36 streams, and continuous or daily stage for 4 streams; continuous elevations for 4 lakes and periodic elevations for 18 lakes; continuous ground water levels for 40 wells, periodic ground water levels for 115 wells, and miscellaneous water level measurements for 295 wells; and quality of water for 36 surface water sites and for 113 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W82-02493

WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1980--VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASINS.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-142688, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PA-80-3, October, 1981. 304 p, 7 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Pennsylvania, Ohio River basin, St. Lawrence River basin.

Water resources data for the 1980 water year for Pennsylvania consist of records of discharge and water quality of streams; elevation and contents of lakes and reservoirs; and water levels of groundwater wells. This volume contains records for water discharge at 82 gaging stations, elevations and contents at 22 lakes and reservoirs, water quality at 28 gaging stations, and water levels as 20 observation wells. Also included are data for 11 crest-stage, 11 low-flow, and 322 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (USGS)
W82-02494

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1980--VOLUME 2. GREEN RIVER BASIN, BEAR RIVER BASIN, AND SNAKE RIVER BASIN.
Geological Survey, Cheyenne, WY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-154337, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WY-80-2, 1981. 269 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Wyoming, Green River basin, Bear River basin, Snake River basin.

Water resources data for the 1980 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Volume 2 of this report contains discharge records for 62 gaging stations, stage and contents for 3 lakes and reservoirs, water quality for 38 gaging stations and 20 ungaged stations, and water levels for 7 observation wells. Also included are 24 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (USGS)
W82-02495

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1980--VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-130485, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-80-1, August, 1981. 234 p, 7 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, Great Lakes basin, Souris-Red-Rainy River basin.

Water-resources data for the 1980 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 54 gaging stations; stage-only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 9 gaging stations, 1 stage station, 14 partial-record lake stations, and 5 wells; and water levels for 45 observation wells. Also included are 51 high-flow partial-record stations and 86 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data, together with the data in Volume 2, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W82-02496

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1980--VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-130493, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-80-2, August, 1981. 435 p, 7 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, Mississippi River basin, Missouri River basin.

Water-resources data for the 1980 water year for Minnesota consist of records of stage, discharge, water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 66 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 35 stream stations, 3 partial-record stream stations, 1 partial-record lake station, and 67 wells; and water levels for 255 observation wells. Also included are 112 high-flow partial record stations and 181 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data, together with the data in Volume 1, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W82-02497

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1980.
Geological Survey, Albuquerque, NM. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-148206, Price codes: A99 in paper copy ($46.50), A01 in microfiche. Geological Survey Water-Data Report NM-80-1, 1981. 679 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New Mexico.

Water resources data for the 1980 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 226 gaging stations, stage and contents for 24 lakes and reservoirs, water quality for 91 gaging stations and 97 observation wells. Also included are 138 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in New Mexico. (USGS)
W82-02498

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1979.
Geological Survey, Louisville, KY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-145053, Price codes: A25 in paper copy, A01 in microfiche. Geological Survey Water-Data Report KY-79-1, 1980. 582 p, 6 Fig, 3 Tab, 7 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Kentucky.

Water resources data for the 1979 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records from 112 gaging stations; stage and contents for 15 lakes; water-quality for 39 stations; suspended-sediment data for 43 stations (6 daily); daily temperature for 35 stations; daily specific conductance for 23 stations; ground water levels for 70 recording, 117 partial, and 1 flowing well; water-quality data from 225 coal hydrology sites (27 partial, 198 miscellaneous), 4 springs and 29 wells; and miscellaneous temperature and specific conductance data from the 114 gaging stations. Also included are data for 124 partial-record crest-stage and 91 partial-record low-flow sites. Data collected at various miscellaneous sites is also published. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (USGS)
W82-02499

HYDROLOGIC RECONNAISSANCE OF THE WASATCH PLATEAU-BOOK CLIFFS COAL-FIELDS AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. M. Waddell, P. K. Contratto, C. T. Sumsion, and J. Butler.
Geological Survey Water-Supply Paper 2068, 1981. 45 p, 10 Fig, 9 Plates, 8 Tab, 19 Ref.

Descriptors: *Hydrologic data, *Maps, *Coal mines, *Groundwater, *Surface water, *Water quality, Geology, Precipitation, Evaporation, Streamflow, Stream discharge, Water temperature, Monitoring, Low flow, Dissolved solids, Springs, Wells, Water analysis, Chemical analysis, *Utah, Wasatch Plateau, Book Cliffs, Coal fields.

Data obtained during a hydrologic reconnaissance in 1975-77 in the Wasatch Plateau-Book Cliffs coal area of Utah were correlated with existing long-term data. Maps were prepared showing average precipitation, average streamflow, stream temperature, ground- and surface-water quality, sediment yield, and geology. Recommendations were made for suggested approaches for continued monitoring in the coal areas. During the 1931-75 water years, the minimum discharges for the five major streams that head in the area ranged from about 12,000 to 26,000 acre-feet per year, and the maximum discharges ranged from about 59,000 to 315,000 acre-feet per year. Correlations indicate that 3 years of low-flow records at stream sites in the Wasatch Plateau would allow the development of relationships with long-term sites that can be used to estimate future low-flow records within a standard error of about 20 percent. Most water-quality degradation in streams occurs along the flanks of the Wasatch Plateau and Book Cliffs. In the uplands, dissolved-solids concentrations generally ranged from less than 100 to about 250 mg/L (milligrams per liter), and in the lowlands the concentrations ranged from about 250 to more than 6,000 mg/L. Most springs in the Wasatch Plateau and Book Cliffs discharge from the Star Point Sandstone or younger formations, and the water generally contains less than about 1,000 mg/L of dissolved solids. The discharges of 65 springs ranged from about 2.0 to 2000 gallons per minute. The Blackhawk Formation, which is the principal coalbearing formation, produces water in many of the mines. The dissolved-solids concentration in water discharging from springs and mines in the Blackhawk ranged from about 60 to 800 mg/L. (USGS)
W82-02500

WATER QUALITY DATA, MACKENZIE RIVER BASIN 1960-1979.
Inland Waters Directorate, Ottawa (Ontario). Water Quality Branch.
Report prepared for the Mackenzie River Basin Committee, 1981, 1081 p.

Descriptors: *Water quality, *Data collections, *Water analyses, Turbidity, Physical parameters, Alkalinity, Major ions, Numerical index, Nutrients, Metals, Percentiles, *Mackenzie River Basin, Athabasca River, NAQUADAT, Peace River, Color, Alberta, British Columbia.

The water quality data presented in this repot have been collected from federal agencies and the provinces of Alberta and British Columbia. The provincial data were reformatted to be compatible with the federal data on the NAQUADAT system. The computerized National Water Quality Data Bank (NAQUADAT) is a repository for water quality information which includes chemical, physical, biological and hydrometric data for surface water, groundwater, wastewater and precipitation. Analytical methods used by the provincial agencies were compared with the analytical procedures described in the NAQUADAT Dictionary. This report presents summary data of water quality samples collected from 1960 to 1979. Since many stations were not sampled for the entire period, the sampling period (period of record) is indicated for each individual station. The data summary is organized according to the seven major sub-basins of the Mackenzie River Basin, namely: (1) Athabasca River Drainage, (2) Peace River Drainage, (3) Liard River Drainage, (4) Hay River Drainage, (5) Great Slave Lake Drainage, (6) Great Bear Lake Drainage, (7) Mackenzie River Drainage. (WATDOC)
W82-02506

GROUND WATER IN WASHINGTON,
Washington State Univ., Pullman. Water Research Center.
For primary bibliographic entry see Field 2F.
W82-02536

THE USE OF GEOLOGIC, HYDROLOGIC, AND GEOCHEMICAL MAPPING TECHNIQUES IN ENVIRONMENTAL ASSESSMENT,
C. J. Coe.
Ground Water, Vol 19, No 6, p 626-634, November/December, 1981. 14 Fig, 13 Ref.

Descriptors: *Environmental effects, *Coal mining, *Mapping, Mining engineering, Manganese, Iron, Sulfate, Hydrogen ion concentration, Specific conductivity, Water quality, Path of pollutats, Groundwater movement, Water pollution effects, Drainage, Mine drainage, Hydrologic maps, Geologic mapping, Subsurface mapping, Topographic mapping, Water level, Wells, Dewatering, Dry wells, Overburden, Acidic water, Economic aspects, Legal aspects.

The environmental and economic impacts of mining can be described before, during, and after operations by using three types of maps: geologic, hydrologic, and geochemical. Geologic maps include cross-section (to define ore veins, aquifers, water-bearing zones, perched water tables, recharge areas, and groundwater movement) and structure contour maps. Static water level maps determine the configuration and transmissivity of the groundwater table. Isoconcentration maps for the desired water quality parameters define the extent of concentration fields, point source locations, and concentration gradients. Considered in tis paper are sulfate, Mn, Fe, pH, and specific conductance. Two Appalachian coal mine sites are given as illustrations. In the first case, the maps showed the location and extent of the coal seams and water bearing zones. Toxic and non-toxic strata were identified. Three groups of people complained that mining had dewatered their wells. The maps helped show that in two locations well levels were lowered by too-close spacing in a new development and by new municipal wells. However, mining activities were responsible for well dewatering along the northern area of the mining site. These wells were located on a perched water table. It was predicted that as mining progresses to the east, more residents would lose their water supplies. In the second case groundwater movement was very complex, beng partially affected by previous surface mining. The isoconcentration maps helped define water quality as affected by mining activities. (Cassar-FRC)
W82-02546

8. ENGINEERING WORKS

8A. Structures

PASSING FLOODWATERS OVER EMBANKMENT DAMS,

Moskovskii Inzhenerno-Fizicheskii Inst. (USSR). Dynamics Lab.
Y. P. Pravidivets, and S. M. Slissky.
International Water Power and Dam Construction, Vol 33, No 7, p 30-32, July, 1981. 2 Fig, 13 Ref.

Descriptors: *Dam construction, *Floodwater, Flood control, Cofferdams, Earth dams, Flooding, *Spillways, Overflow channels, Embankments.

A specially developed facing which allows flood waters to be passed over the face of an earth dam has been found to considerably reduce the costs of embankment dam construction. To provide stability and to protect the dam faces against erosion, riprap, wire mesh, anchored beams, or concrete slabs are used. There have been some cases where unit discharges over protected low-head embankments were as large as 40-70 cubic meters/sec/meter. With the increase of embankment height, the unit discharge over rockfill dams decreases. Protecting the slopes with packed edge-to-edge concrete cubes increases the unit discharge over an embankment structure by up to 2.5-3 times as compared with facing with crushed rock of the same size and specific gravity. Substantial economic advantages have been achieved using precast reinforced concrete wedge-shaped slabs with drainage holes as protective facing. The presence of additional hydrodynamic force on the upper slab surface brought about almost 3-5 times the reduction of the slab thickness, compared with concrete cubes of the same size. A spillway of limited width built in the river channel section of the dam has been developed which allows dimping to continue in the rest of the dam during the flood. The underlying drainage filter, drain holes, their dimensions and spacing play a substantial part in providing the stability of the slabs. The drain holes in the slabs are round and 4-5 cm in diameter, but not larger than the uppermost grain size of the filter material. The stepped toe of the spillway chute protects the embankment dam from erosion and provides the surface type conjunction of the jet and the tailwater. (Baker-FRC)
W82-02204

USE OF HORIZONTAL DRAINS: CASE HISTORIES FROM THE COLORADO DIVISION OF HIGHWAYS,
R. K. Barrett.
Transportation Research Record, No 783, p 20-25, 1980. 3 Fig, 4 Ref.

Descriptors: Drains, *Highway effects, *Case studies, *Drainage, *Drilling, Highways, Drain practices, Drain spacing, Drilling equipment, *Subsurface drainage, Controlled drainage, Interstitial water, Pipes, Erosion, Soil stability, Construction methods, *Drainage engineering, Colorado.

Four case histories of horizontal drains installed on Interstate 70 in the Vail, Colorado vicinity are described. In the first case, horizontal drains were used as a postconstruction alternative to a deep underdrain trench that would have cut across the roadway. In the second case, horizontal drains were used to improve drainage behind a cut slope. At the third site, horizontal drains were used to improve slope stability prior to construction of a major reinforced-earth wall. Two series of holes were drilled. Water levels were reduced to about 17 m below the ground surface. At the fourth site, the drains were used for correction of a major cut-slope failure that occurred during construction. In every case, horizontal drains contributed to the successful completion of construction, at a lower cost than many of the alternative methods of correcting for soil instability. (Titus-FRC)
W82-02211

LONG TERM PERFORMANCE OF HORIZONTAL DRAINS,
D. D. Smith.
Transportation Research Record, No 783, p 39-45, 1980. 10 Fig, 2 Tab, 1 Ref.

Descriptors: Drains, *Highway effects, Case studies, *Drainage, Drilling, Highways, Drain practices, Drain spacing, Drilling equipment, Subsurface drainage, Controlled drainage, Interstitial water, *Pipes, Erosion, Soil stability, Construction methods, *Drainage engineering.

Major factors that influence the performance of horizontal drains are discussed. These include location and installation methods, the frequency and quality of inspections, cleaning and maintenance programs, the types of casing used, the lithologic characteristics of the site, the pH and mineral content of the groundwater, and the protective measures necessary to preserve external features such as outlets and collector systems. The long-term performance of three drainage projects is evaluated. After 20 years, major problems encountered with the drains were rusted pipes, root growth, and the sloughing of weathered slopes which buried the outlets. (Titus-FRC)
W82-02212

MISSISSIPPI'S EXPERIENCE WITH HORIZONTALLY DRILLED DRAINS AND CONDUITS IN SOIL,
W. T. Ruff.
Transportation Research Record, No 783, p 35-38, 1980. 6 Fig, 2 Ref.

Descriptors: *Conduits, *Landslides, *Highway effects, *Case studies, *Drainage, Drilling, Trench drains, Highways, Drain practices, Drain spacing, Drilling equipment, Subsurface drainage, Controlled drainage, Interstitial water, Pipes, Erosion, Soil stability, Construction methods, *Drainage engineering, Mississippi.

The experience of the Mississippi Highway Department in accomplishing subsurface drainage by using horizontally drilled drains and conduits is described. Horizontal drilling plans were found to be more flexible and less risky than excavation plans. Alterations in a drilling plan can be made without affecting the completed portions. At one site, large-diameter interconnecting vertically-drilled shafts were constructed to create a drainable reservoir in a deep irregular formation. These were installed for forty percent of the cost of a braced excavation. At a second site, long horizontally drilled perforated drains were used to reduce the water table in an active landslide. Some of the major deficiencies with this technique include difficulty of maintaining a desired slope and the problem of clogged drains. (Titus-FRC)
W82-02213

ROCKWOOD EMBANKMENT SLIDE BETWEEN STATIONS 2001+00 AND 2018+00: A HORIZONTAL DRAIN CASE HISTORY,
W. D. Trolinger.
Transportation Research Record, No 783, p 26-30, 1980. 1 Tab.

Descriptors: *Embankments, *Water table, *Highway effects, *Case studies, *Drainage, Drilling, Trench drains, Highways, Drain practices, Drain spacing, Drilling equipment, Subsurface drainage, Controlled drainage, Interstitial water, Pipes, Erosion, Soil stability, Construction methods, *Drainage engineering, Tennessee.

Horizontal drains were installed along a highway construction site to alleviate the soil instability which produced frequent landslides on Interstate 40 in Tennessee. Areas with perched water table and zones of deep failure were located with the aid of piezometers. Horizontal drains were installed along the toe of the embankment. Vertical movement at the scarp has been reduced from 152-203 mm per year to 7.5 mm per year. (Titus-FRC)
W82-02214

HORIZONTAL DRAINS AND HORIZONTAL DRILLING: AN OVERVIEW,
D. L. Royster.
Transportation Research Record, No 783, p 16-20, 1980. 5 Fig, 10 Ref.

Descriptors: Drain practices, *Drain spacing, Drilling, *Interstitial water, *Pipes, Drainage, Drains, Drilling equipment, *Subsurface drainage, Controlled drainage, Water transport, Erosion, Soil stability, Construction equipment, Construction methods, *Drainage engineering.

The use of horizontal drains to remove subsurface water is reviewed. Development of polyvinyl chloride pipe, improvements in drill bits and drill stem, and the development of drilling machines capable of producing high thrust and torque have made subsurface drainage a significant and economical alternative in the repair and prevention of some types of landslides. Little is known about the effectiveness of horizontal drains in various geologic materials or about the capabilities of the drilling equipment. Use of horizontal drains is more frequent in the western region of the United States. (Titus-FRC)
W82-02215

SURFACE WATER HYDROLOGIC CRITERIA FOR URANIUM MINE TAILINGS IMPOUNDMENTS IN ONTARIO,
MacLaren (James F.) Ltd., Willowdale (Ontario).
For primary bibliographic entry see Field 5E.
W82-02240

LOOP EQUATIONS WITH UNKNOWN PIPE CHARACTERISTICS,
IBM Scientific Center, Haifa (Israel).
For primary bibliographic entry see Field 3F.
W82-02258

42-MILE WATER PIPELINE FOR COAL BOOM TOWN.
For primary bibliographic entry see Field 6D.
W82-02359

FIELD STUDIES OF THE TEMPERATURE REGIME AND STRESS STATE OF THE CONCRETE IN ARCH DAMS SUBJECTED TO VARIOUS METHODS OF COOLING,
I. F. Blinov, Yu. P. Shaikin, and I. R. Gal'perin.
Hydrotechnical Construction, No 1, p 19-23, January, 1980. 2 Fig, 2 Tab, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 1, p 12-15, January, 1980.

Descriptors: *Concrete technology, *Arch dams, Construction, Construction methods, Cooling, *Temperature effects, Dams, Concrete testing, Stress analysis.

During the planning stages of dam construction, the temperature requirements for the concreting of blocks are determined so that the negative effect of temperature deformations can be reduced and the appearance of thermal cracks eliminated. The temperature-stress state of concrete blocks depends on the temperature regime, the physicomechanical characteristics of the concrete, the dimensions of the block, the ratio of the elastic moduli of the elastic moduli of the block concrete and foundation bed, and additional factors. The Kasseb Dam in Tunis and the Mansur Eddakhbi Dam in Morocco are provided with monitoring and measuring instruments to study the temperature regime and deformations of the concrete in the blocks and to investigate their stress-strain state due to live loads. According to design requirements the maximum temperature of the concrete blocks in the rock zone should not exceed 36 degrees C for the Kasseb Dam or 32 degrees C for the Mansur Dam. Concrete at both dams was cooled by the continuous surface spraying of the horizontal and lateral faces, while concrete in the Mansur Dam was cooled additionally using tubes in which water cooled to 10-13 degrees C was circulated. Chilled water was also used in batching the concrete. The large differences in the structural parameters of the two dams and in the climatic conditions under which they were constructed made it possible to compare the strains of the concrete cooled by various methods such as surface spraying or tube cooling. Analysis of the data made it possible to conclude the feasibility of constructing arch dams with the parameters under consideration without use of tube cooling of the concrete in a hot climate where certain requirements are met. (Baker-FRC)
W82-02387

HIGH-HEAD VERTICAL LIFT GATES,
K. I. Mel'nichenko.

Hydrotechnical Construction, No 3, p 237-240, March, 1980. 3 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 16-18, March, 1980.

Descriptors: *Gates, *Hydroelectric plants, Powerplants, Spillway gates, Dams, Hydraulic gates, Construction, *Design criteria.

A caterpillar gate with a span of 3.5 meters and height of 9.0 meters was constructed for a head of 120 meters at the Nurek hydroelectric station. Use of such gates can improve the layout, reduce the cost, and increase the reliability of hydroelectric plants, especially plants of the Nurek or Rogun type, where construction involves the driving of numerous tunnels during the entire construction period. Much has been accomplished in recent studies concerning the creation of high-head vertical lift gates, as a result of which it was possible to use them in the large construction at Nurek hydroelectric. A qualitatively new approach in the manufacture and assembly of these gates was required. Means and resources must not be dispersed for the creation of numerous new types of gates. Careful study must be made in each instance to determine which type is the best. The emergency-guard ring-follower gate of the spillway of the Inguri hydrostation should be considered the most reliable and most perfect of the gates designed by special designs departments in this area. The gate is suitable for use in conduits in both the construction and operating periods. (Baker-FRC)
W82-02388

FLEXIBLE OUTFALL AT ALDEBURGH,
Anglian Water Authority (England).
A. L. Davis.
Effluent and Water Treatment Journal, Vol 20, No 7, p 338-340, 342, July, 1980. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Outfall sewers, *Flexibility, *Pipes, Underwater, Wastewater disposal, Design criteria, *Aldeburgh, *England, Costs.

A flexible sewage sea outfall was designed and installed at Aldeburgh, Suffolk, a town whose population ranges from 3500 to 5000 depending on the season. The pipe, constructed of high density polyethylene with layers of cotton tape, steel tape, polyvinyl chloride tape, galvanized steel wires, jute and asphalt, and an outside coat of helical-wound, asphalt-coated 2 mm steel wires, has a 202 mm internal diameter and is 1.3 km long. The discharge point is 10-12 meters deep and in a relatively level area of the sea bed. There are two diffusers, each 125 mm in diameter. Modeling pollution data revealed that the probable E. coli count would be 900 per 100 ml when the sewage field was under the influence of strong on-shore winds. Float tests indicated that beaching of floats may occur upon release of sewage shortly before a combination of high tide and easterly on-shore winds. Costs of pipe supply, laying, and burial were 250,000 pounds sterling, or 192 pounds sterling per meter. (Cassar-FRC)
W82-02415

SKI-JUMP SPILLWAY FOR INDIA'S UKAI DAM,
Central Designs Organisation, Gujarat State (India). Irrigation Dept.
V. N. Kulkarni, and I. C. Patel.
International Water Power and Dam Construction, Vol 33, No 9, p 44-48, September, 1981. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Dams, *Spillways, Overflow channels, Construction methods, *Ukai dam, *India, Scour, Erosion, *Performance evaluation.

The Ukai earth dam across the Tapi River in Gujarat, India, has a masonry spillway and incorporates a powerhouse. The dam is part of a multipurpose scheme designed to provide irrigation, flood control and 300 MV of hydropower. The spillway with 22 radial gates is on the left bank of the river. The discharge rate of the spillway is about 97.6 cubic meters/second/meter. The occurrence of Deccan traps in the impact area and the availability of a standing pool of water created by the Kalkrapar weir 30 kilometers downstream favored the provision of a ski-jump type of bucket rather than a stilling basin. The spillway has been in operation since 1971. The maximum scour, about 29 meters deep, was noted in the tail channel opposite spillway gates 8, 9, and 10, and more scour about 12 meters deep was noted downstream of spillway gates 18 and 19. The pattern is being watched; it now appears to be stabilizing, so that no further scour or retrogression is anticipated that might need large-scale protective measures. Model studies of the erosion of rock from the impact area of the ski-jump were performed. It is believed that the mobile bed consisting of sand or gravel effectively represented the rocky condition found at the site. The benefit of the ski-jump as opposed to stilling basins or roller buckets is that with the ski-jump, erosion takes place away from the structure. Considering the usual tendency of the scour pocket to form away from the dam, the performance of the bucket thus far is rated satisfactory. (Baker-FRC)
W82-02430

8B. Hydraulics

TURBULENCE MODEL FOR FLOW OVER DREDGED CHANNELS,
Thessaloniki Univ., Salonika (Greece). Dept. of Hydraulics.
C. Koutitas, and B. O'Connor.
Journal of the Hydraulics Division. Proceedings of the American Society of Civil Engineers, Vol 107, No HY8, p 989-1002, August, 1981. 12 Fig, 11 Ref.

Descriptors: *Turbulent flow, *Channels, *Flow characteristics, Model studies, Dredging, Silting, Sediment transport, Computer models.

Computer methods were used to reproduce flow and mixing patterns in a steep-sided channel dredged at right angles to the main direction of flow and sediment transport. The mixed finite-difference/finite-element method was acceptable for modeling both uniform and nonuniform steady flows. These computer methods, based on fundamental flow equations, used a hydrostatic pressure approximation, which worked better where main flow was nearly horizontal than where flow converged and was more vertical. The method can be used either with mixing length models or with one-equation turbulence models. The one-equation turbulence model produced a better fit to laboratory data and obviated the problem of singular kinematic eddy viscosity values. (Cassar-FRC)
W82-02201

VELOCITY PROFILES WITH SUSPENDED SEDIMENT,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2J.
W82-02581

8C. Hydraulic Machinery

HYDRAULIC GATES,
J. Lewin.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 3, p 237-255, May, 1980. 9 Fig, 1 Tab, 51 Ref.

Descriptors: *Hydraulic gates, *Design criteria, *Radial gates, Gates, Bibliographies, Reviews, Roller gates, Spillway gates, Sluice gates, Ice, Vibrations, Seals, Control system.

This paper summarizes design aspects of low head and vertical lift hydraulic gates, commonly used in rivers, canals, and reservoir spillways. Radial gates are actuated by the water level upstream or downstream of the gate. Forces exerted on the gate by changes in the displacers in each side pier cause the gate to open and close. Vertical lift gates are usually of the fixed roller type, with either side guide rollers or water lubricated slippers to provide transverse stability. Bottom hinged flap gates are used to prevent intrusion of saline water into a fresh water course. Design of bottom and side seals is important to prevent excess leakage and interference of debris. Design considerations discussed are coefficient of discharge (0.3-0.6 for submerged discharge and 0.5 to 0.7 for free discharge), jet contraction coefficient for the discharge under a vertical flat sluice gate, hydraulic downpull forces, guide roller grooves, structural analysis to avoid vibrations, and methods of removing debris and ice. Operating machinery is described. Seals for top, bottom, and sides of the gates are of many types: bulb seals in the shape of musical notes (usually solid), L-shaped seals (used in one-plane movement), double-stem or center bulb seals (for face contact and sealing the top edge of submerged vertical lift gates and radial culvert gates), vibrations--preventing self-exciting vibrations, reduction of the rate of self-control and sufficient structural strength and rigidity to withstand the hydrodynamic load. (Cassar-FRC)
W82-02206

8D. Soil Mechanics

THE STEADY STATE OF DEFORMATION,
Geothechnical Engineers Inc., Winchester, MA.
S. J. Poulos.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT5, p 553-562, May, 1981. 2 Fig, 15 Ref.

Descriptors: *Deformation, *Soil properties, Soil mechanics, Soil horizons, Soil profiles, Soil dynamics, Shear stress, Strength, Stress, Shear tests, Soil types, Liquefaction, Interstitial water, Drainage.

The concept of steady-state deformation in particulate media is defined and explained with special reference to soils. The steady state deformation for any mass of particles is that state in which the mass is continuously deforming at constant volume, constant normal effective stress, constant shear stress, and constant velocity. This steady state is achieved only after all particle orientation has reached a statistically steady-state condition and after all particle breakage, if any, is complete, so that the shear stress needed to continue deformation and the velocity of deformation remain constant. Several practical applications of the concept of steady-state deformation include the understanding of pore pressures measured in situ before, during and well after a failure to more clearly understand the causes of the failure, the selection of shear strength when analyzing the stability of slopes and the selection of an appropriate factor of safety based on improved knowledge, the correct selection of apparatus for particular applications as they relate to the shape of the stress-strain curve, and understanding the relationship between the stress-strain curves of sands and those of clays in clearer terms. Terminology such as 'normally consolidated' and 'loose' can be understood in terms of soil behavior as opposed to 'over-consolidated' and 'dense'. (Baker-FRC)
W82-02235

RELATIONSHIP OF ELECTRICAL DISPERSION TO SOIL PROPERTIES,
Battelle Memorial Inst., Columbus, OH.
S. S. Smith, and K. Arulanandan.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT5, p 591-604, May, 1981. 8 Fig, 3 Tab, 15 Ref.

Descriptors: *Soil properties, *Electric currents, *Hydraulic permeability, Permeability, Permeability coefficient, Soil texture, Pore size, Pores, Soil porosity, Model studies, Minerals.

In an effort to develop a nondestructive method for studying and predicting engineering properties of fine grained soils, a simplified three element electrical model is presented to represent the complicated soil-water system. The model exhibits a theoretical apparent dielectric and conductivity dispersion in the radio frequency range. The parameters of the model are both compositional and heterogeneous (structural). For a particular soil system, the numerical values of the model param-

eters can be determined by computer curve fitting the theoretical equations of the model to the experimentally determined radio frequency apparent dielectric and conductivity dispersion curves of the soil. The fundamental nature of electrical dispersion in fine grained soils and the three numerical parameters of the model present an effective nondestructive tool for studying the engineering behavior of soils in a fundamental, quantitative manner. The pertinent results of three studies are included in the paper. The three studies included evaluate the model's ability to monitor structural changes during the hydration of soil cement, the relationship between dielectric constant of wet soil cluster and swell potential, and the relationship between the size and distribution of intercluster pores and hydraulic permeability. (Baker-FRC)
W82-02561

8E. Rock Mechanics and Geology

A FORMULA FOR ESTIMATING FISSURE TRANSMISSIVITIES FROM STEADY-STATE INJECTION-TEST DATA,
Institute of Geological Sciences, Wallingford (England).
J. A. Barker.
Journal of Hydrology, Vol 52, No 3/4, p 337-346, July, 1981. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *Transmissivity, *Geologic fractures, *Permeability coefficient, *Hydraulic conductivity, Hydraulic engineering, Mathematical studies, Estimating equations, Injection.

A formula was developed for estimating fissure transmissivities in a rock formation from steady-state injection-testing between two inflated packers in a borehole. Sample data for injection into a fissure is used to demonstrate practical application of the formula. In most cases transmissivity can be calculated by an iterative procedure. Errors introduced by non-Darcian flow and finite packer-separation can be calculated by extrapolation. Two equations are presented which can estimate errors resulting from inaccuracies in the measurements. Thus, local hydraulic conductivity can be determined fairly simply for a rock formation. (Small-FRC)
W82-02292

8G. Materials

SOLAR HEAT POND SYSTEM,
Howard County Farm Bureau, Nashville, AR.
For primary bibliographic entry see Field 3F.
W82-02187

MEMBRANE LINER SEALS 278-ACRE RESERVOIR.
Public Works, Vol 112, No 2, p 72-74, February, 1981.

Descriptors: *Reservoir linings, *Hydroelectric plants, *Forebays, Materials engineering, Materials testing, Seepage, Seepage control, Environmental effects, Penstocks, *Plastics, Powerplants, Leadville, Colorado.

The world's largest single-cell membrane reservoir liner was installed in a 278-acre forebay reservoir near Leadville, Colorado by B. F. Goodrich. The reservoir will be part of the Mt. Elbert Power Plant which will service Colorado customers during peak load hours. Water will be released from the forebay through two 180-inch diameter penstocks, and drop 445 feet to drive two 100-megawatt turbine generators. The water is released to Twin Lakes where it may be pumped back to the forebay reservoir during periods of low demand. Before the liner was installed, indications of seepage of water through the soil from the reservoir caused project engineers to decide on the installation of the liner. The contract price for installation of the liner was set at $17.8 million. Complication earth-moving and processing operations were required before liner installation. The liner is made of chlorinated polyethylene of three ply construction with a total thickness of 45 mils. Each panel was laboratory tested for integrity before installation. Environmental impact tests by the Federal Government on the Mt. Elbert installation and the Fryingpan-Arkansas Project started several years ago. Possible dispersion of sediments into the water due to turbulence is expected to be minimal, as are dangers to public safety. (Geiger-FRC)
W82-02361

TRENDS IN WASTEWATER COLLECTION SYSTEMS,
G. E. Symons.
Water/Engineering and Management, Vol 128, No 4, p 10, 90, April, 1981.

Descriptors: *Wastewater management, *Reviews, Regulations, Catchment basins, Design criteria, Pipes, Flow measurement, *Construction materials, *Sewer systems, Costs.

Large increases in cost of sewer construction have been noted over the past 20 years in the wastewater collection systems industry. The cost of sewer construction in 1980 was 4 times the cost in 1957-59. Other trends have also occurred, but have been less obvious. Changes have occurred in materials of construction and in problems of management. Sewers were constructed of brick and cement mortar or tile, concrete poured in wooden forms, monolithic concrete sewer, and finally prestressed concrete pipes of almost any size, evolving to the presently used materials. Forcemains changed from cast-iron through cement-lined steel, to concrete and plastic. Wastewater treatment processes also became more sophisticated. Flow measurement has increased in accuracy. Federal legislation, regulations and implementation policies have forced designers, managers, and operators to improve the sampling of sewers to determine the character of the wastes. Of large current interest is the matter of combined-sewer overflows and how to control them. The use of stormwater detention is under study. Surface detention areas such as athletic fields, parking lots, and rooftops have been considered, but problems with water stagnation and mosquitoes may be experienced. Minimization of safety hazards in sewers caused by hydrogen sulfide is receiving increased attention. Computer management is being investigated. A sewer maintenance program is not required by EPA regulations as a condition for treatment plant construction awards. (Baker-FRC)
W82-02573

8I. Fisheries Engineering

ON THE DYNAMICS OF FEEDING OF YOUNG FISH FROM MOZHAYSK RESERVOIR IN VARIOUS YEARS,
Moscow State Univ. (USSR). Dept. of Ichthyology.
For primary bibliographic entry see Field 2H.
W82-02434

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

INSTITUTIONAL BARRIERS TO WATER QUALITY PLANNING AND MANAGEMENT IN THE SOUTHEAST, VOL III - ANNOTATED BIBLIOGRAPHY,
Tennessee Univ., Knoxville. Graduate School of Planning.
G. E. Bowen, and T. R. Gangaware.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153552, Price codes: A03 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, May, 1981. 43 p. OWRT-C-90234-U(9434)(1), 14-34-0001-9434.

Descriptors: *Bibliographies, *Water quality management, *Institutional constraints, Urban planning, Water pollution, *Information retrieval, Publications.

This volume of the report, the annotated bibliography, was intended to be a basic reference source for persons engaged in water quality planning, management, and research. The annotations are divided into six basic categories: books, periodicals, government publications, conference proceedings, water resource center reports and others. (Gangaware-Tenn)
W82-02103

10D. Specialized Information Center Services

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and B. M. Myers.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $14.00, Microfiche $3.50. Geological Survey Open-File Report 81-904 (supersedes Open-File Report 80-555), 1981. 102 p, 1 Fig, 2 Ref.

Descriptors: *Data storage and retrieval, *Information exchange, *Organizations, Indexing, Data transmission, *Organization identification code, Computerized data systems, *U.S. Geological Survey, National Water Data Exchange(NAWDEX).

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), and Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (USGS)
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